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MELODIES AND HOW TO HARMONIZE THEM

WITH ILLUSTRATIONS FROM ANCIENT AND MODERN SOURCES

BY

EDMONDSTOUNE DUNCAN

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To

SIR HUBERT PARRY, BART.

MUS. DOC., M. A., OXON. ET CANTAB.

Professor of Music in the University of Oxford, Director of the Royal College of Music, London, this little book is respectfully dedicated by his former pupil,

The Author.

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PREFACE.

WHEN Thomas Morley in 1597 issued his "Plaine and easie Introduction to practicall Musicke" he exclaimed on the great difficulty in setting down rules such as might stand the test of practical experience. "Then did I see," he continues, "the most part of mine owne precepts false and easie to be confuted by the works of Taverner, Fairfax, Cooper, and infinite more, whose names it would be too tedious to set downe in this place."

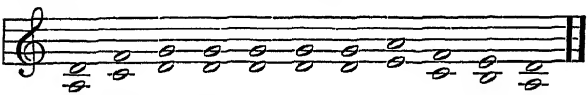
Writers of our own day need fear no longer the confutations of Taverner, Fairfax and Cooper; but Prout, Macfarren and Ouseley may cause them to think twice before venturing unarmed (with well-tested maxims) into their domain. The author of the present little work, (rightly or wrongly), has no such concern. For as little attempt has been made to reduce the practice (of adding parts beneath melodies) to any very definite rule, so is there but small risk of setting down hasty conclusions, that appear as rules to the eye, but do not bear the proof of practice. For his rules, the student must still go to the harmony-book, which of course cannot be dispensed with.

Illustration is here employed; and by illustration alone, in the author's opinion, can the *Harmonization of Melodies* be adequately taught. A book

thus designed has, however, this important recommendation, namely, that it is practically a systematised reproduction of the same process that took place in the gradual development of the science of harmony, as it is known to-day.*

Briefly to mention the early history connected with this matter, it appears that though the ancients knew of the simpler harmonic combinations and even tabulated them, as far as is known they put them to no practical use. The Greek scales, full of melodic resource, proved unsuitable for harmony, or at least rendered the task a very difficult one.†

Hucbald, (who lived until about 930), is generally credited with being the first to collect and set forth the initial attempts of the earliest known harmonists, of whom in all likelihood he himself was one. In his § "Musica Enchiriadis," he mentions that "there are three kinds of symphony," (i. e., harmony) "in the fourth, fifth, and octave, and as the combination of some letters and syllables is more pleasing to the ear than others, so it is with sounds in music. All mixtures are not equally sweet."

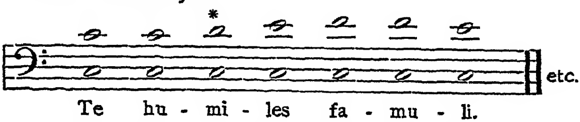


* "Formerly they used to compose from the bass, but modern authors compose from the treble, when they make counterpoint or basses to tunes or songs"—the opposite view is thus expressed in "The Art of Descant," attributed to Henry Purcell.— Playford's Introduction, 10th edition, 1683.

† The material and origin of Polyphony with the Greeks is well shown in "The Oxford History of Music" (Vol. 1) by Professor Wooldridge.

§ Odo, abbot of Tomières, has been latterly credited with the authorship of this ancient and learned work.

Burney quotes the above example from Hucbald, and adds, speaking of that which immediately follows: — "Hucbald's idea that one voice might wander at pleasure through the scale, while the others remained fixed, shows him to have been a man of genius and enlarged views, who, disregarding rules, could penetrate beyond the miserable practice of his time, into our points d'orgue, pedale, and multifarious harmony upon a holding note, or single bass, and suggest the principle, at least, of the boldest modern harmony."



"The origin of passing notes is indicated," says Sir Hubert Parry, "as will be observed in the use of a ninth transitionally between the combinations of the octave and the tenth." (See * in above example.)

The use of consecutive fourths and fifths, now, of course, abandoned, lasted no less than four centuries. Through the succeeding stages of the development of harmony it is not the author's intention to go. One important issue may, however, be noted, namely the discovery of counterpoint, thought by Helmholtz to be a chance discovery "to amuse social meetings."* For "it was a new and amusing discovery that two totally independent melodies might be sung together and yet sound well." Thus originated the "Discantus" or counterpoint of Franco of Cologne, and in due season the whole practice of counterpoint which reached such a remarkable perfection during the period from the 14th to the 17th centuries.

* This need not be taken too seriously. The old Greek system of *magadizing* is to be regarded as the fundamental principle of Polyphony.

But for the history of the growth of harmony and counterpoint readers must be referred to the numerous volumes which directly treat of these matters.

The aim of our book is chiefly practical.

An average student finds it difficult to begin harmonizing melodies, and he is usually left to pick it up by himself, with what aid he may derive from counterpoint and occasional remarks from his teacher.

To such an one, the present treatise should appeal, while to the really gifted student, (who finds melodies and basses offer no difference in degree of difficulty), benefit may accrue from a perusal of the examples, some of which are rare.* Doubtless the most sensible method of employing the work will be to use it concurrently with a Manual on Harmony. Of the older text-books Goss's may be recommended for the excellence of its examples. Those who desire something newer will do well to turn to Dr. Charles Vincent's "Harmony Diatonic and Chromatic," — one of the most practical of modern treatises. In due course, as the student advances, his attention should be directed to the works of Dr. Prout, in whose safe hands we may leave him.

In order then to assist the average student, to help to prepare him for any of the best class of examinations, and to encourage a more intelligent view of the making of music, this modest little essay is put forward in the confident belief that some such work has long been wanted.

EDMONDSTOUNE DUNCAN.

January, 1905.

*An analytical key, in course of preparation, will offer many interesting solutions of the 110 exercises contained in the present volume.

CONTENTS.

MELODIES AND HOW TO HARMONIZE THEM.

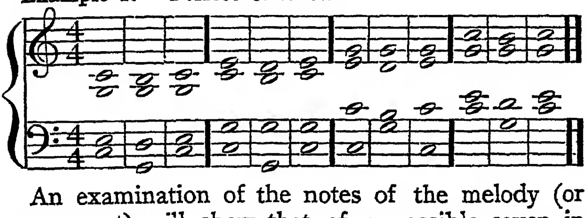
CHAPTER I.

STUDY OF CADENCES.

A SIMPLE and practical introduction to the harmonization of melodies will be found in the **study of cadences.**

The half-close and perfect cadence sharing the same chords, namely, tonic and dominant, may be taken first. Keeping both chords in their root form, but with the several notes in turn in the top part, we obtain some such result as the following:

Example I. — Perfect Cadences.

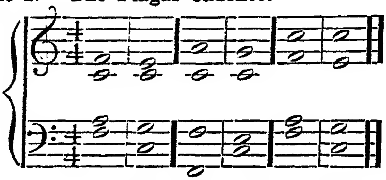


An examination of the notes of the melody (or upper part) will show that of a possible seven in the scale, we can, by means of these two chords, already harmonize five degrees of the scale.

EXERCISE I. — Transpose Example I into the attendant keys of G and F, either with an instrument or on paper.

With the help of the **Plagal Cadence** we shall be enabled to complete the harmonization of the scale, for the first of its two chords (the subdominant) contains the two notes which before we were obliged to pass over. These, of course, were the 4th and 6th of the scale.

Example 2.—The Plagal Cadence.



EXERCISE 2.—Transpose the plagal cadence, in its three positions, to the attendant keys of G and F.

From the three chords thus far employed, we may now construct a table, showing suitable chords to be placed beneath each degree of the major scale.

Melody.	**Harmony.**	**Richter's Figuring.**
1ST NOTE	Tonic or Subdominant.	1 1 or 4 I IV
2D NOTE	Dominant.	2 5 V
3D NOTE	Tonic.	3 1 I
4TH NOTE	Subdominant.	4 4 IV
5TH NOTE	Tonic or Dominant.	5 1 or 5 I V

6TH NOTE	Subdominant	$\left\{\begin{array}{l}\frac{6}{4}\\ \text{IV}\end{array}\right.$
7TH NOTE	Dominant	$\left\{\begin{array}{l}\frac{7}{5}\\ \text{V}\end{array}\right.$
8TH NOTE	Tonic	$\left\{\begin{array}{l}\frac{8}{1}\\ \text{I}\end{array}\right.$

The upper figure (in the third column) shows the melody note, the lower figure gives the bass note, and the Roman numeral gives the root. This is a modification of the well-known system invented by Gottfried Weber, and since followed by M. Hauptmann, E. F. E. Richter, and most recent writers. See also, Chap. X., of Dr Vincent's "Harmony," which gives an ingenious system for the figuring of *melodies.*

With the assistance of the table, let us now harmonize a major scale.

Example 3.

EXERCISE 3.—Transpose the above passage to the keys of G and F.

Observe the awkward motion of the bass in the above example. The progression from subdominant to dominant in the sixth and seventh bars is also unsatisfactory. The chords are excellent in themselves, but do not progress naturally. Let us now extend our table of chords, not by adding new ones, but by means of inversions of the three in use.

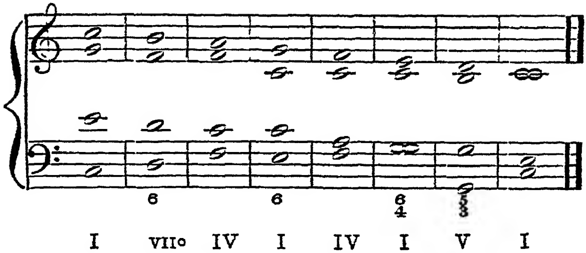
A 2nd major table, admitting a few inversions.

1st Note	Tonic, Subdominant and their inversions.	1 . . . 1 3 5 I . . .	1 . . . 4 6 8 IV . .
2nd Note	Dominant, and its first inversion.	2 5 V	2 7
3rd Note	Tonic, and its 2nd inversion only.	3 1 I	3 5
4th Note	Subdominant, and its inversions.	4 . . . 4 6 1 IV . .	
5th Note	Tonic, and its inversions, Dominant, and its 1st inversion.	5 . . . 1 3 5 I . . .	5 . . . 5 7 V . . .
6th Note	Subdominant, and the 2nd inversion.	6 . . . 4 1 IV . .	
7th Note	Dominant, and 6–3 or 6–4–3 on 2nd degree of the bass.	7 5 V	7 2
8th Note	(Like No. 1.)	(See No. 1.)	

With the greater freedom allowed by our table, we may now obtain some such result as the following:

Example 4.—The Scale harmonized with Triads and some inversions.

I V I IV I IV V I

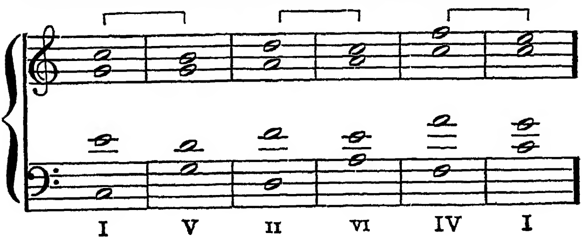


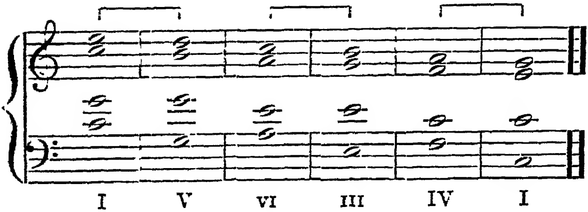
EXERCISE 4.—Transpose Example 4 into the keys of G and F.

It will be seen from the above example that though the roots of the chords employed are unchanged, the inversions allow of our avoiding the wide skips of the previous bass, while the whole effect is smoother and more connected.

Let us now add to the list (of available chords) the triads formed on the supertonic, mediant and submediant. These, being minor triads, belong as much, or more, to the relative minor key. They are especially useful in sequences of chords; as for example, in the following or any similar passage.

Example 5.—Sequence, employing the three minor triads.





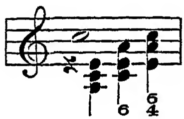
EXERCISE 5.— Transpose into G and F.

The progression of the first two chords, which may be taken as a half-close (in C major), or even as a plagal cadence (in G major), is systematically reproduced by advancing one step (of a note or two) at a time; (bars 1 to 6). Another sequence * of descending notes follows; (bars 7 to 12).

The use of these additional chords considered from the point of view of the melody is shown in the next table.

Treble. **Chord.**

1ST NOTE



Triad (and inversions) of Sub-mediant.

I ...
6 1 3
VI ..

2ND NOTE

Triad (and inversions) on Supertonic.

2 ...
2 4 6
II ...

3RD NOTE

Triad (and inversions) on Mediant.

3 ...
3 5 7
III ..

* Chapter VII treats of Sequences.

4TH NOTE

(Like No. 2.)
4 . . .
2 4 6
II . .

5TH NOTE

(Like No 3.)
5 . . .
3 5 7
III . .

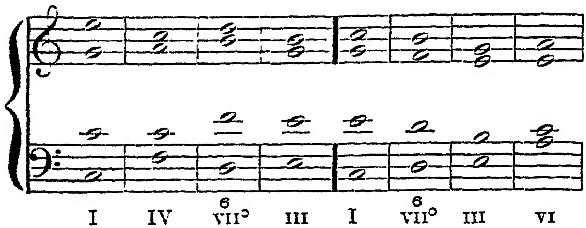
6TH NOTE

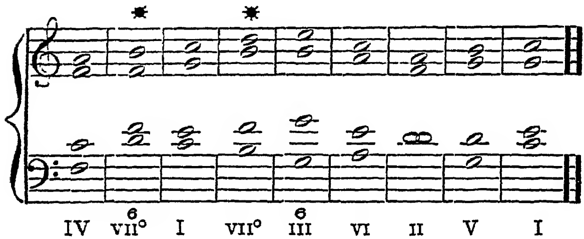
(Like No. 2.)
6 . . .
2 4 6
II . .

7TH NOTE (No change.)

The triad (the Diminished) which is formed on the 7th or leading note, does not properly belong to the major key, though even there it has a limited use, especially in sequences of chords; it will therefore be included in the table of chords for the minor scales. One illustration of its general employment in the major key may be given in passing. (See Ex. 6.)

Example 6.— Showing a manner of introducing the diminished triad in a major key.





EXERCISE 6.—Transpose into other keys such as G and F.

From the above example it may be seen that the diminished triad is employed beneath numbers 7 and 2 of the major scale (when in the melody) and that the first inversion of the same chord is also available under those notes. (See *.)

Here are the same chords figured.

8	6	7	5	8	6	7	5	3	1	2	7
1	4	7	3	3	4	2	3	1	4	2	3
I	IV	VII°	III	I	IV	VII°	III	I	IV	VII°	III

1	7	5	6	6	7	8	2	3	1	6	7	8
1	2	3	6	4	2	1	7	5	6	2	5	1
I	VII°	III	VI	IV	VII°	I	VII°	III	VI	II	V	I

It is to be observed that the Diminished triad is chiefly useful when the next note of the melody **avoids the tonic,** and invites the support of a minor triad. The second inversion of the diminished triad is rarely used in the major key.

Example 7.

BLOW THY HORN, HUNTER.

From an early 16th Century MS.
in the British Museum.

The three-part example (No. 7) is quoted from an early 16th century MS in the British Museum. Notice how the harmony, which is copied exactly,* omits the 3rd in bar 4 and crosses the two upper parts in bar 6. Note may also be taken of the F-natural in bar 7 (see the middle part), and another crossing of the parts in the 10th bar.

Example 8.

"WATKINS ALE."

From the Fitzwilliam Virginal Book.

Anon. (Version perhaps by Dr. Bull.)

* The song also allows of the melody being placed in the middle, with the (present) 2nd voice above it (transposed an octave).

Our Example 8 is selected from the so-called "Queen Elizabeth's Virginal Book."* The harmony is perhaps by Dr. Bull. It is almost entirely done in triads, and not until the 7th bar is an inversion introduced. The air was once exceedingly popular.

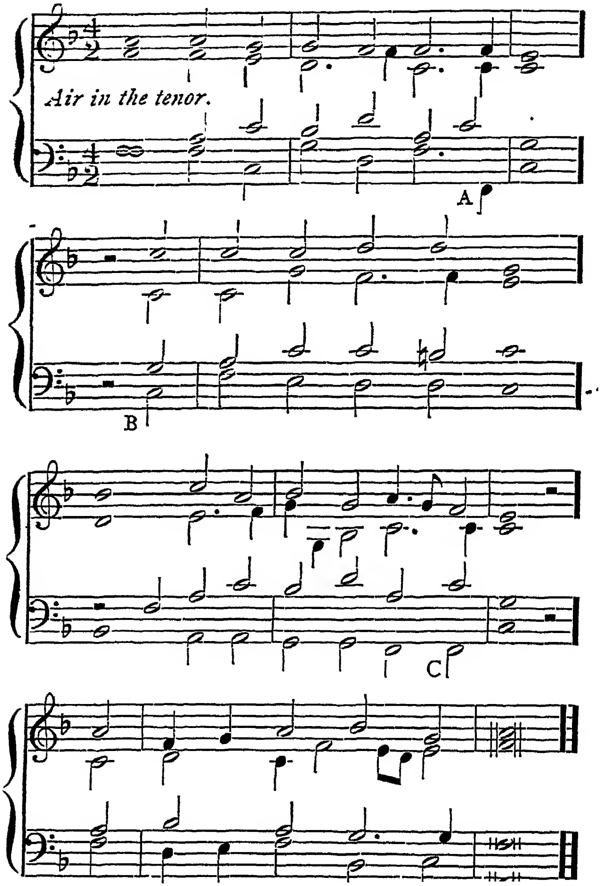
*The popular name for the "Fitzwilliam Virginal Book" (written between 1550–1620).

Example 9.

YORKE TUNE.

(Ravenscroft, 1621.)

John Milton.



Example No. 9 is taken from Ravenscroft's Psalter, 1621. The melody is placed in the tenor, and the harmony mostly made up of triads. It is by John Milton, the father of the poet. Note that the 3rd is three times omitted (see A, B, and C). It must be pointed out that modern four-part harmony requires this interval to be present in all triads, the exceptions to this rule being few and far between.

General hints on writing basses.*

With the table of chords shown (on p. 4) to be available for the major key, the student may now proceed to write a bass to a given melody; several examples of such a procedure follow. Let us take for example the first melody in Goss's "Introduction;"—(Chapter 20).

Example 10. A B C D E F G

I IV IV I IV I V I

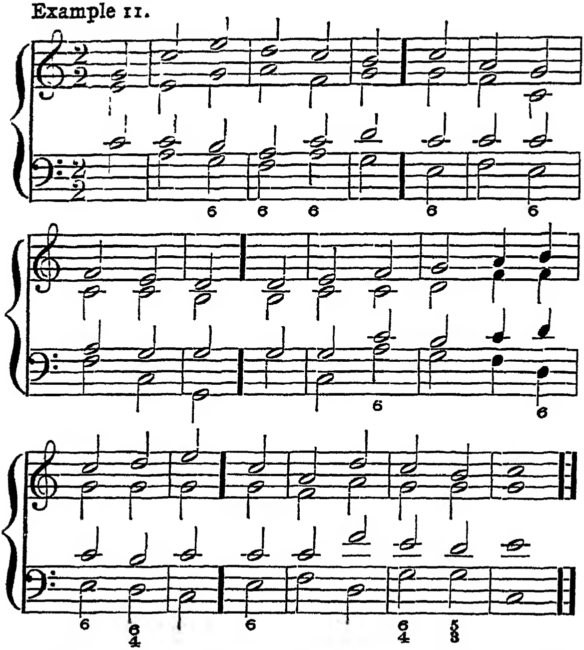
In the above example, the second chord is taken in its first inversion. By this means the root position of the subdominant chord (see "B") is successfully approached, by contrary motion, with the two inner parts stationary—always of good effect. Another first inversion is employed for the fourth chord ("C"), which enables the bass to avoid the tonic, which is better kept for the final chord. At "D," "E," "F," and "G" may be seen the ordinary method of harmonizing the alphabetical series of notes, Nos. 4, 3, 2, and 1 of the scale. By means of the 6–4 chord at "E," we may again avoid the root position of the tonic-chord,† which appears in

* See also p. 34.
† This cannot always be done, but it is well to aim at it.

its true place at the end. Let the contrary motion of the bass be carefully noted. In the one place where melody and bass proceed in the same direction (downwards), at "C" and "D," the tenor moves upwards, while the alto is stationary. For smooth chord-writing nothing could be better. In the analysis of a simple passage like this, the student may discover some of the elementary considerations upon which the whole fabric of harmony rests.

Here is another simple strain, drawn from the same source, which comprises a series of notes for the most part alphabetical.*

Example 11.



* As the late Sir George Grove pointed out, many of Beethoven's finest melodies consist of an alphabetical series of notes; e. g., the theme of the finale of the Ninth Symphony.

Several of the same features reappear. Thus there is the same attempt at contrary motion, between treble and bass, and a like aim at keeping the inner parts (or at least one of them) stationary, when the treble and bass move in the same direction.

Simple harmonies should be added to the following **ten short melodies,** (Exercises 7 to 16). The table on page 4 will show the principal chords necessary, but occasional use should be made of the supplementary chords given on page 6.

EXERCISE 7.

EXERCISE 8.

EXERCISE 9.

EXERCISE 10.

EXERCISE 11.

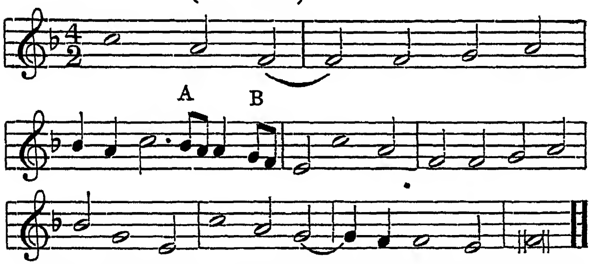
EXERCISE 12.

EXERCISE 13.

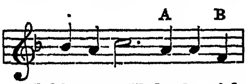
EXERCISE 14.

EXERCISE 15.

EXERCISE 16 (see note).



Note that the first quaver at "A" and at "B" in Exercise 16 may be ignored, so that the melody could be read thus:



[Chapter V deals with passing-notes.]

CHAPTER II.

THE MINOR SCALES IN ASSOCIATION WITH HARMONY.

The three forms of the **minor scales,** which are the three varieties now in use of the Locrian or Hypodorian octave (A to A) agree only so far as the first five notes (counting upwards) are concerned.*

Following the same method employed in regard to the major scale, the two cadences (the half-close and the perfect) may first be applied.

Example 12.

EXERCISE 17.—Transpose Example 12 into the keys of E minor and D minor.

The result is similar to that obtained in Example 1, where all the notes of the scale were harmonized with the exception of the 4th and 6th. These two omissions are supplied with the help of a minor plagal cadence.

* The *Common*, or *Locrian*, or *Hypodorian* octave (A to A) has given us the starting-point of our modern notation; for mediæval musicians, after many experiments, finally settled on calling this octave by the first seven letters of our alphabet." Story of Notation. Abdy Williams. (p. 29.)

Example 13.—Plagal Cadence in Minor Key.

When final.

Exercise 18.—Transpose the above cadences into E minor and D minor.

It will be seen from the above example that a major third is introduced in the last chord. The old name for this is the "tierce de Picardie," which commonly appears in the last chord of a minor piece. It may, however, be used in any part of a composition, if it be properly balanced by minor chords.

The table which follows is nearly identical with that given for the major key. It must not be forgotten, however, that as there is an accidentally raised leading-note in the minor, all dominant chords and their inversions are liable to contain that interval.

Table of Minor Scale.

Melody.	**Harmony.**	**Figuring.**
1st Note	Tonic or Subdominant triads.	$\frac{1}{1\quad 4}$ I IV
2nd Note	Dominant (with *raised* third)	$\frac{2}{5}$ V
3rd Note	Tonic triad.	$\frac{3}{1}$ I
4th Note	Subdominant.	$\frac{4}{4}$ IV

5TH NOTE	Tonic triad, or Dominant triad with a raised third.	5 / 1 5 / I V
6TH NOTE	(When not raised accidentally) Subdominant triad.	6 / 4 / IV
7TH NOTE	(Raised) Dominant triad (with *raised* third).	7 / 5 / V
8TH NOTE	(Same as No. 1).	(See No. 1).

Example 14.—The Harmonic Minor Scale harmonized in three chords.

EXERCISE 19.—Transpose to E minor and D minor.

The effect of the harmonies in Example 14 (like the corresponding one at No. 3) is obviously crude

With the assistance of the **inversions** of the triads above employed, and to these may now be added the triad on the supertonic and that on the submediant, together with their first inversions, the following table is constructed. In each case the principal chord, suitable for use, is placed first.

Extended table of triads and inversions, for minor scales.

1st Note	Tonic and inversions; Subdominant and inversions	1 1 1 3 5 4 6 1 I IV
	Submediant, (though rarely with inversions).	1 6 (1) (3) VI
2nd Note	Dominant (with major 3rd,) and inversions; and triad (rarely) on Supertonic, and its 1st inversion (commonly).	2 2 5 7 2 (2) 4 V . . . II°
3rd Note	Tonic triad and inversions, and Submediant triad.	3 3 1 3 5 6 I . . . VI
4th Note	Subdominant triad and inversions; Supertonic triad and 1st inversion.	4 4 4 6 1 2 4 IV . . II°
5th Note	Dominant (with major 3rd) and inversions, and Tonic triad and inversions.	5 5 5 7 2 1 3 5 V . . I . . .
6th Note	(without being raised) Triad and inversions on Subdominant; and triad and 1st inversion on Submediant.	6 6 4 6 1 6 1 IV . . VI .
7th Note	(raised) Triad on the Dominant, (with major 3rd) and its 2nd inversion, [or 6–3 on Supertonic].	7 5 2 V . .
8th Note	(Like No. 1.)	(See No. 1.)

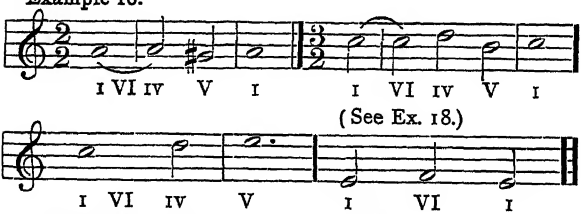
The inclusion of the 6–3, on a supertonic bass, is somewhat anticipating the chapter on the dominant seventh, to which the chord properly belongs. It is convenient, however, to admit this form of it at the present stage. The inversions (in brackets) are rarely to be used in early practice; while those omitted are better left alone.

Example 15.—Harmonic minor scale harmonized.

Exercise 20.—Transpose Example 15 to E minor and D minor.

Returning to the consideration of the 1st, 3d and 6th notes of the melody in connection with the use of the submediant triad (VI), phrases like the following commonly call for the employment of that chord, in one position or another.

Example 16.



* The wide skip in the second bar of Example 15 could have easily been avoided, by the bass proceeding downwards, to "B"; the parts, however, would have been somewhat too separated.

In the first three of these phrases, the sustained note seems to suggest a change of harmony from the tonic;—thus (See chords marked *).

Example 17.

EXERCISE 21.—Transpose Example 17 to E minor and D minor.

The chord will prove effective where a relief from the tonic is required, or in proceeding to the subdominant, or in approaching a half-close, or lastly, a perfect cadence. In the remaining melodic phrase, the submediant harmony (in its first inversion) may be thus introduced:—

Example 18.

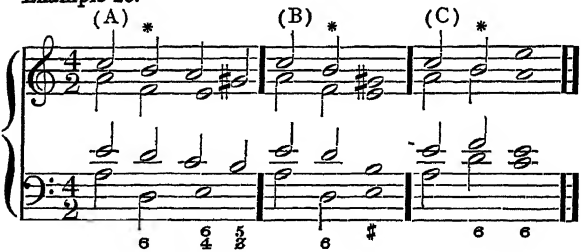
EXERCISE 22.—Transpose Example 18 to E minor and D minor.

When the triad itself is employed (beneath No. 6 of the melody) the progression will be somewhat similar:—viz., tonic to dominant, with sometimes a chord between—such as an inversion of the tonic—or it may return to the original chord, or be used to avoid a tonic chord in a cadence.

Example 19.

In a succession of notes in the melody such as 3 2 1 7 (see A), 3 2 7 (see B), or 3 2 5 (see C), the first inversion of the supertonic triad (i.e., a chord of the sixth on the subdominant) may be effectively introduced, as thus:—

Example 20.



Exercise 23.—Transpose to other keys, such as E minor or D minor.

† Compare Example 48.

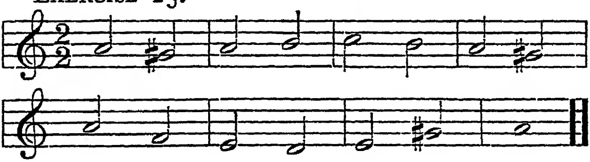
The triad itself on the supertonic is rarely used. The example quoted (No. 21) shows how both chords may be employed in approaching a final cadence.

Example 21.

EXERCISE 24.—Transpose Example 21 to G minor and C minor.

Exercises 25 to 30 are designed to put into practice those observations which have gone before. All the passages are strictly minor, so the table dealing with that form of the scale may be drawn upon exclusively.

EXERCISE 25.



EXERCISE 26.

EXERCISE 27.

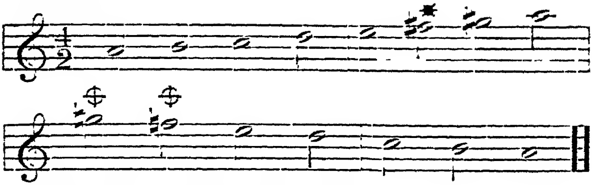
EXERCISE 28.

EXERCISE 29.

EXERCISE 30.

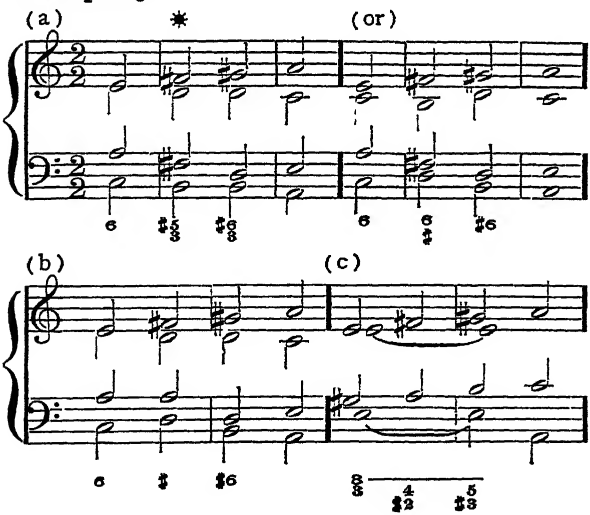
Hitherto the harmonic minor scale has been referred to. In regard to the oldest form, namely the Locrian, little need here be said, as its harmonic possibilities are small. Moreover its peculiarity of having a sixth and seventh, both minor, is common in descending to the **Melodic** (or Arbitrary) **minor scale**; to the discussion of which we may then proceed.

Example 22.



This form of the minor offers some new features. The sixth note of the melody (✱) when thus accidentally raised may be supported by a triad (or first inversion) on the supertonic, or by a triad on the subdominant. Both forms are little used nowadays, and a commoner method of dealing with the accidentally raised sixth is seen at Example 23 (c) where the dominant is held in the bass as a pedal.

Example 23.



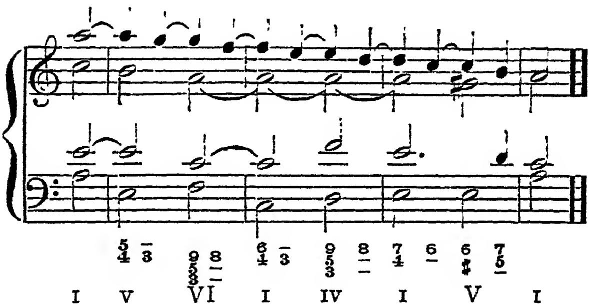
(d) A simple harmonization, when the 6th and 7th are *not* raised.

(e) The same, with a difference.

EXERCISE 31.—Transpose Example 23 into D minor and E minor.

When the seventh and sixth are **not** accidentally raised, as in the descending form of the scale under consideration, the most usual chords to employ are the triads. The example also quotes the same notes accompanied by sixths, and the triads suspended. (See Example 24.)

Example 24. ✷ ✷



EXERCISE 32.—Transpose Example 24 into B minor and C minor.

Example 25, ("We be Soldiers Three"), serves to show how the minor was treated in the early seventeenth century, and with what ease the different forms of the minor scale were blended. (See bars 2 and 4; also 6 and 8, etc.)

Henry Lawes, friend of the poet Milton, left many good specimens of three-part music. The following (Example 26) illustrates his use of the minor key, when employing harmony. Observe the opening chord with its bare fifth, which is not to be imitated.

Example 25.

"WE BE SOLDIERS THREE."

From RAVENSCROFT'S
"Deuteromelia" (1609).

Example 26.*

"COME, CHLORIS, HIE WE TO THY BOWER."

From "Ayres and Dialogues," (Book I, 1653). HENRY LAWES.

*Another version (from a 17th Century MS) is quoted in Example 100. (p. 122).

The advanced student may pass lightly over the letter-press from this point to Example 33.

The next two examples illustrate the use of the tables of chords when applied to the minor key.

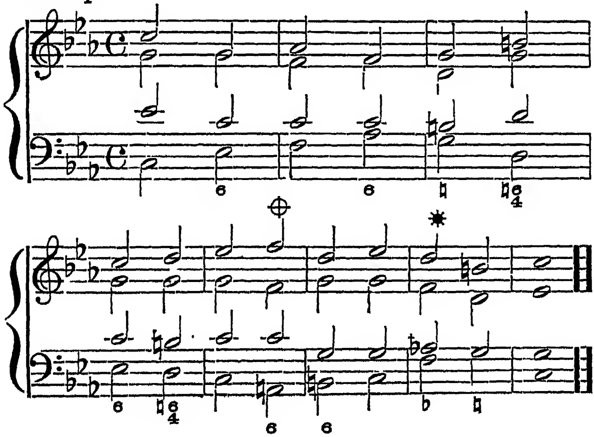
Example 27.

In Example 27 (A) the leading-note is supported by the chord of the 6th, though the dominant chord would have been nearly as useful. In the second bar (at B) observe how the parts are stationary, while the treble moves down a 4th. Intervals that belong to the same chord are effectively treated in this manner. Another instance of a similar kind is seen at C, in the next bar, where, however, for the mere sake of variety the second chord is changed to

a first inversion. When the melody gives the notes Nos. 4, 3, and 2 of the scale (especially as the last notes of any short melodic phrase), the **Half-close** is as a rule intended, as at D, in our example. This is always the case in the middle of a paragraph, where a cadence of one kind or another naturally falls. The accidental cannot be forgotten, if the chord-table for the minor is consulted. At E the bass is formed on the melodic minor scale, an example of which was given in Example 23 (*d* and *e*). Instead of the 6th on G♮ the first inversion of the key-note triad was equally available.

The ascent of a 5th in the melody (see F) is covered by the tenor-part serving as a hinge, and also by the fact that though the bass rises (in the same direction) a whole octave, all the intervals are common to both chords. At G the ordinary perfect cadence must, of course, have an accidentally raised leading-note.

Example 28.

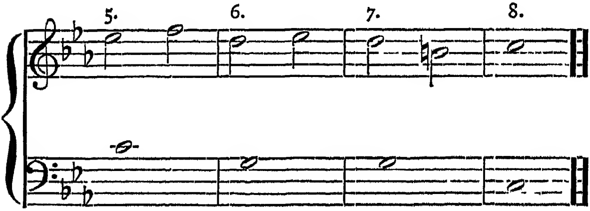


In the fifth bar of the last example (see ⊕) the chord of the 6th used is made "accidentally" major, in preference to having the interval of an augmented 2nd (A-flat to B-natural) in the bass. There are examples given of this form of the minor scale at Example 23 (b and c) where they occur in the melody. In place of the chord at ⊕, the subdominant triad had been equally effective. The Cadence approach (✱) was given in Example 20 (B). It will be observed both in Examples 27 and 28 how naturally the triad and its own inversion (or *vice versa*) may succeed each other.

If the student experiences any difficulty in composing (at this stage) a good working bass to an ordinary melody (without chromatics and modulation) the following method may be employed.

Take your melody and mark the likely places for the triads, thus:

Example 29.



The bass thus formed is derived from our table for the minor scale. Proceeding to the intermediate notes; the table would allow a dominant chord for the second note of melody. On testing it we obtain this result, which is unsatisfactory if the triad (Example 30A), and worse still if the inversions, be used. The latter therefore are not quoted.

Example 30.

A. B.

The harmony at "A" is only unsatisfactory and not impossible; but the 8ves in the bass (by contrary motion) are unnecessary, and the progression from dominant triad to subdominant is harsh and unusual, so they may be dismissed. There is still the solution at "B" in the same example (No. 30) which is derived from employing the melodic form of the minor scale descending, as shown in Example 24. This, however, leads us away from the triad selected to follow; namely, that on F. Returning to our table, we are allowed beneath the fifth note of melody to employ the tonic or its inversions. To write another tonic for the bass-note would be monotonous, while a second inversion, the 6–4 on G, would lead to 8ves, as at Example 30A. Therefore there is no other alternative but to take the first inversion of the tonic chord and to proceed thus:—

Example 31.

The table for the minor scale excludes the triad on the bass note E-flat, which is outside the key, and need not therefore be discussed.

In bar 2, treble and bass merely exchange, so evidently the most natural movement is from triad to inversion.

Bar 3 has the same feature.

Bars 4 and 5 contain the tonic, dominant, tonic, harmonies derived from our list. To avoid monotony one of the tonics must be changed to an inversion or avoided altogether. The two methods give this result:—

Example 32.

(With inversion)   or

(Avoiding inversion)

In bars 5 and 6 the second note in melody had better take an inversion, in each case to avoid too wide a skip in the bass.

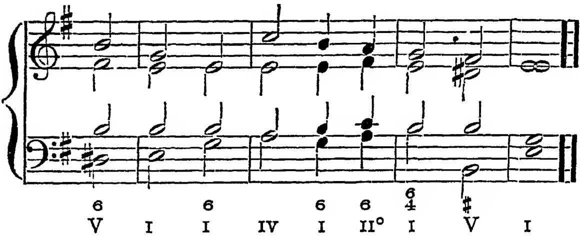
At bar 7, the bass note (the dominant) has just been used, so substitute the progression shown at Example 20B.

By following the considerations shown in the above analysis, the student will find he can with confidence produce a bass of sufficient correctness to support an ordinary diatonic and non-modulating melody which will further admit of the two inner parts being added.

* The submediant chord is included beneath No. 1 of the table.

In the **supplementary examples** (adapted from Goss) remarks will be only added where necessary.

Example 33.



In Example 33, the opening notes may be expressed together with their proper harmonies by means of a common formula, so that when the melody (major or minor) employs these degrees of the scale, viz., 5–1–3, they may be represented thus: *

5 –	1 –	3 –
Tonic.	Tonic in first inversion.	Tonic.

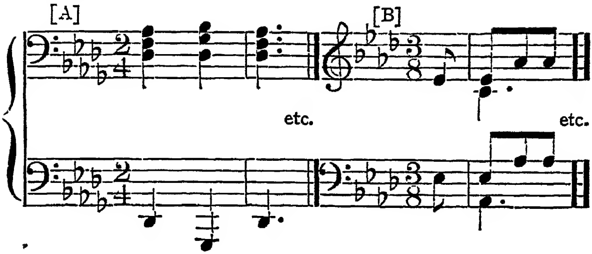
Half-closes such as 4 3 2, or endings like 4 3 2 1, may similarly be treated, e. g.,

4	3	2	1
Subdom.	Tonic (in 2nd inversion.)	Dom.	Tonic.

As both Examples 34 (A and B) **begin** with the 5th degree of melody, it is well to regard it as a rule (with a few exceptions, however,) that in beginning, tonic harmony is desired. It may also be added that sometimes the 5th note is merely doubled at the unison and 8ve, immediately proceeding to tonic harmony. Both the succeeding little examples are drawn from Beethoven. (See Example 34, A and B.)

* The lower part of the formula uses words, as these stand for both minor and major chords.

Example 34.



Example 35 is adapted from a melody by Goss, chromatics and modulations **not** (so far) being admitted.

Example 35.

The great use of chords of the sixth is shown above, where quite half of the example (No. 35) employs nothing else.

In the exercises which follow (Nos. 33–38) there are both passing-notes and modulations. These, however, are so simple that only a few words of explanation are necessary. The passing-notes occur in the melody at the **second** of any two quavers (in Exercises 33, 34, 35, and 36); the first only needs harmonization; ignore the second. [Chapter V deals more fully with passing-notes.]

With regard to the modulations, these are merely **relative**, and, as both major and minor have now been treated of, the student will have no difficulty in following the general directions already given.

Each melody should be carefully examined before the harmonization is begun, as it is only by this means that the character of the scale (i. e. major or minor) can be determined. See also the chapter on modulation. (Chap. IV.)

Exercise 33.

EXERCISE 34.

EXERCISE 35.

EXERCISE 36.

EXERCISE 37.—Place the melody in the Tenor, as in Example 9. (See note below.)

EXERCISE 38.

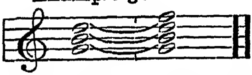
NOTE. If the student finds the above exercise (No. 37) beyond his powers, let him transpose it an octave, and place three parts beneath it, in the ordinary way.

CHAPTER III.

THE DOMINANT SEVENTH.

HITHERTO only the dominant triad, and its inversions, have been employed in the perfect cadence, the half-close and the combinations thence arising. If to the dominant triad we now add the minor seventh from the root, thus:

Example 36.



we obtain a new and important chord, which will be especially useful in harmonizing the fourth degree of the scale, in a manner not before admissible. The chord is only too easily put to a foolish use, so it has hitherto been kept back, on the principle of the wise painter reserving the gayer colours of his palette until good command is obtained of those of more sober hue.

The Dominant Seventh was long in establishing itself as an independent chord, that is to say as a chord to be used apart from preparation either of tied notes or passing-notes. Claude Monteverde (1568–1643) is, by common consent,* credited with the discovery. This was published in his Fifth Book of Madrigals, at the close of the 16th century, and was then considered a bold departure from the old contrapuntal habits of the time.

* According to the late Sir George Macfarren "Jean Mouton, 1475–1522, is the earliest musician in whose works has been found an example of the phenomenal chord of the Dominant Seventh approached with the full freedom of present-day practice." (*Encyclopedia Britannica*, art. "Music.") Fétis credits Luca Marenzio (1560–1599) with the first complete Dominant Seventh.

In the examples which follow, the gradual use of the dominant seventh may be easily traced. Each of the two-part carols from which quotation is made contains a palpable dominant seventh, but both instances may be regarded as mere chance combinations produced by the use of ornamental notes, or passing notes — as the case may be.*

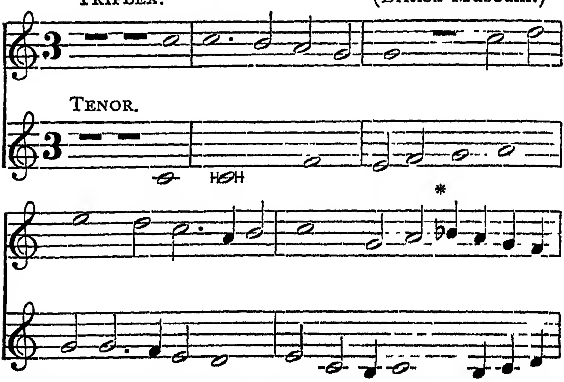
Example 37. 15th Century Carol. (MS. Trinity Coll. Camb.)

Example 38.

IN DIE NATIVITATIS.

15th Century MS. (British Museum.)

TRIPLEX.



* An astonishing example, in four-part harmony, by Guillaume de Machault (dated 1364) may be seen in Grove's Dictionary, vol. iii., p. 12.

The extract from Henry VIII, (with, of course, his own harmony), introduces us to an undoubted dominant seventh (see Example 39), but again the chord is approached and quitted as a combination arising from the passing-note in the treble part. Between bars 3 and 4 may be seen the unusual progression which gives all the effect of consecutive fifths (treble and bass) without being strictly speaking present, owing to the crossing of the parts.*

Example 39.

Henry VIII (1491–1547.)
From a manuscript in the British Museum.

* The melody is given in large notes.

The next three examples may be usefully classed together. They serve to illustrate the old contrapuntal system of employing some of the inversions of the Dominant Seventh. Byrde's passage gives an interesting delayed resolution of the 7th itself, (bar 2). The extract from Willaert (Example 41, bar 3) shows a second inversion brought about (probably) by the tenor part being regarded as a passing-note, the note A being otherwise understood.

The three last chords of Mouton's example give a surprising instance of the last inversion of the dominant seventh (prepared) and its resolution. As in the Royal example quoted above, the impression of 5ths is observable, owing to the re-entry of the bass on the note G.

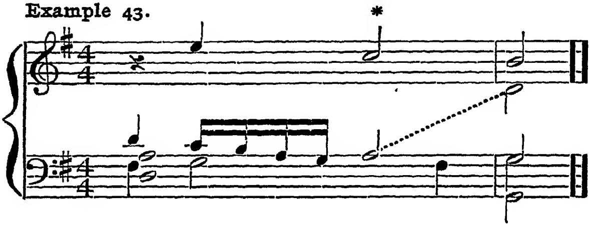
Example 40. WM. BYRDE.

Example 41. ADRIAN WILLAERT.

Example 42. JEAN MOUTON.
(Dodecachordon.)

We now come to Monteverde's method of employing the chord under consideration. The example (from his madrigal "Cruda Amarilli") is a famous one, and will be found to be a distinct advance upon our previous illustrations in that it employs neither preparation nor passing-notes.

Example 43.



This novel method of treating the chord met with great opposition, which, however, was triumphantly overcome. To quote Sir Hubert Parry:—"The deeply ingrained habits of taking the chords wherever they lay, according to the old teaching of Descant, retarded considerably the recognition of the Dominant and Tonic as the two poles of the harmonic circle of the key; but Monteverde's use of the seventh, above quoted, shows a decided approach to it.

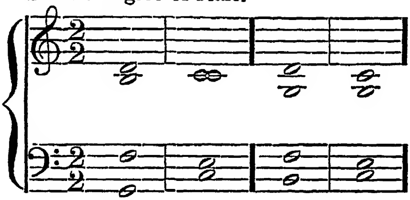
Moreover, in works of this time (early 17th century) the universality of the harmonic cadence, as distinguished from the cadences of the Ecclesiastical modes, becomes apparent."

The practical application of the use of the dominant seventh is seen from the following table, which is followed by the musical illustrations belonging to it.

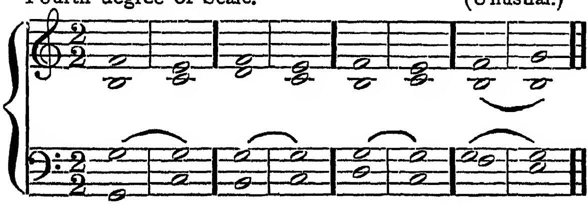
2nd degree of scale in melody.	$\dfrac{2}{5\ 7\ 2\ 4}$
4th degree of scale in melody.	$\dfrac{4}{5\ 7\ 2\ 4}$
5th degree of scale in melody.	$\dfrac{5}{5\ 7\ 2\ 4}$
7th degree of scale in melody.	$\dfrac{7}{5\ 7\ 2\ 4}$

Example 44.

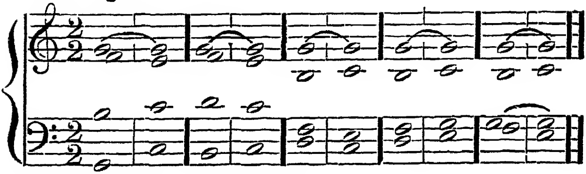
Second degree of scale.



Fourth degree of Scale. (Unusual.)



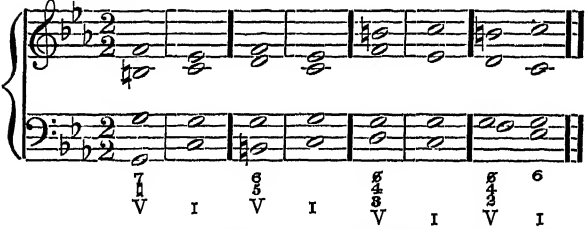
Fifth degree of Scale.



Seventh degree. (Unusual.)

Dominant sevenths are precisely the same in either the major or (tonic) minor keys. Care, however, must be taken to put the necessary accidental to the 3rd of the chord, when in a minor key.* One example with the figures will sufficiently illustrate this.

Example 45.



An example (see No. 46) is added of the "unusual" employment of the *fourth* degree of the scale supported by a 6–4–2 with the same note as a Bass. The passage is quoted from Purcell's opera *Bonduca.*

* Because it is the raised leading-note, and without it the chord of the Dominant minor 7th cannot be formed.

Example 46.

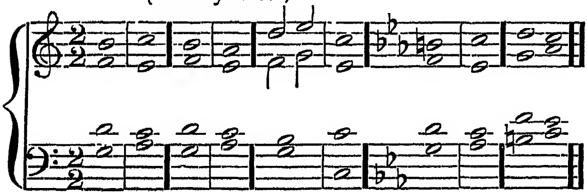
("BRITONS, STRIKE HOME.")*

PURCELL.

The resolution of the dominant seventh does not, of course, necessarily lead to a tonic chord, as in the perfect cadence. Example 47 gives the most useful of the so-called "interrupted cadences" which avoid the tonic chord.

Example 47.

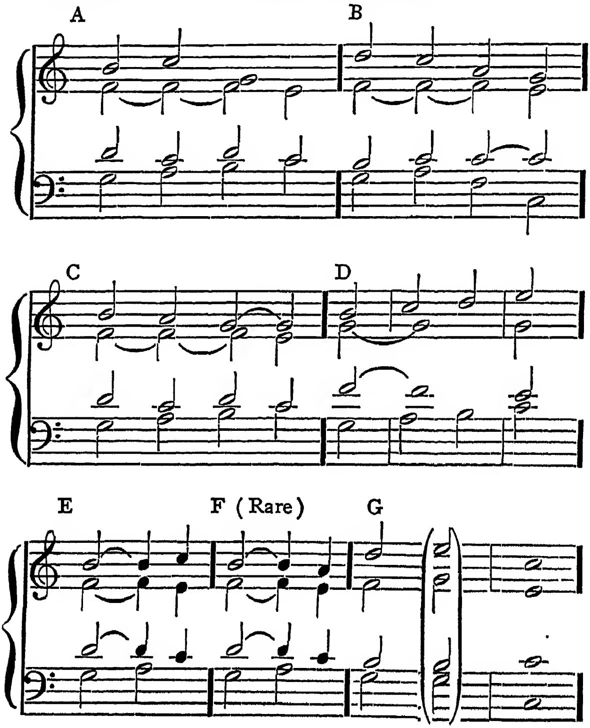
(Rarely used.)



* Scored for strings, with a Trumpet doubling the top part. The harmonies are an exact transcript of Purcell's.

As the resolution of the dominant seventh is commonly and conveniently delayed, a few examples are added showing the usual method in which this is done. The progressions at C and F cannot be transferred to the minor owing to the peculiarity of the descending minor scale. An alternative is offered at H.

Example 48.—Some delayed resolutions.

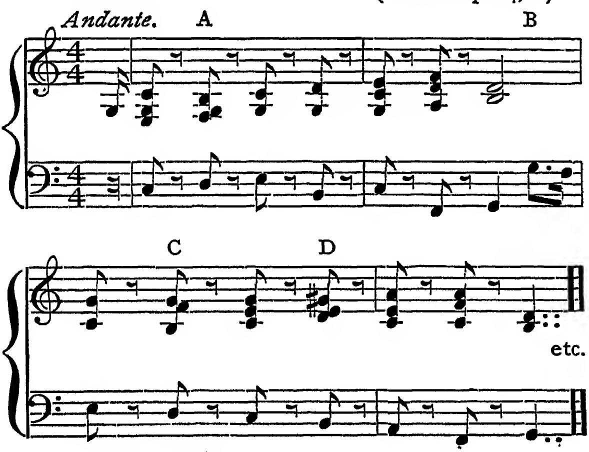


H

Our quotation from Beethoven serves well to show the character the dominant seventh can impart when properly employed. Let the student play over the example omitting the 7th (F), afterwards observing the effect when added. Note that at "D" the dominant 7th of A minor appears,* so the 7th is, of course, the note D, counting from E which is the dominant.

Example 49.

BEETHOVEN.
(Sonata Op. 14, 2.)



* In its second inversion.

Two short extracts from Schumann further emphasize the remarkable character of the Dominant Seventh.

Example 50. SCHUMANN'S Kreisleriana, (No. 6.)

Molto lento.

And again, later in the same movement:—

Example 51.

Our remaining examples offer plain successions of the chord employed in four-part harmony in the

major and minor keys. In closing the chapter mention may be made of two unusual instances of the use of the chord of the Dominant Seventh, namely in Dvorak's "Songs my Mother Taught Me" and in Chopin's Prelude in F (No. 23, Op. 28), inasmuch as the first piece named opens with this chord and the other closes with it. Other instances may perhaps be easily found but it is enough to observe here that they are not recommended for imitation, though in their place they are excellent.

Example 52.

Example 53.

The six exercises below are designed to admit of the employment of the dominant seventh and its inversions, as shown in the two preceding examples.

EXERCISE 39.

EXERCISE 40.

EXERCISE 41.

EXERCISE 42.

EXERCISE 43.

EXERCISE 44.

CHAPTER IV.

MODULATION.

In harmonizing melodies the student will ask himself "How am I to know **when to modulate**, and to what key?"

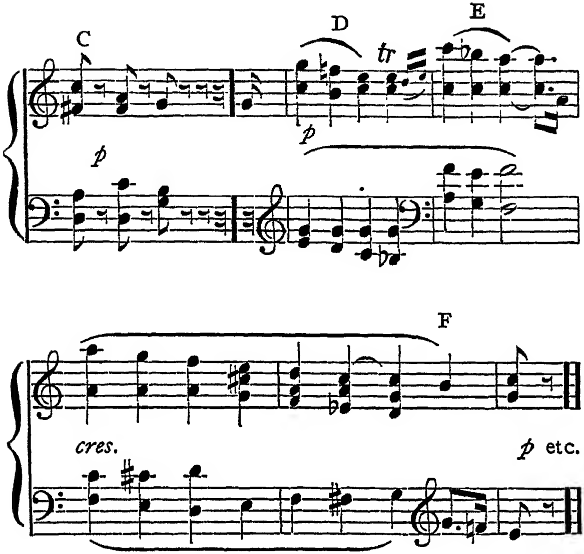
Without attempting to give an exhaustive reply to the dual question, the present chapter, it is hoped, will enable all following out its methods to solve for themselves such melodic problems as they arise.

An accidental, sharp, flat, or natural, in the melody, is, as a rule, the first indication of a modulation.

For instance, turning to Example 49 (page 53), at the letter "D", the sharp prefixed to the G is a leading-note and introduces the perfect cadence in A minor.

Let us continue the passage a little further: —

Example 54.



At the places marked A, B, D, and E the accidentals have each a different meaning. The sharp at A is a leading-note, (in key of G), the flat at B is a mere chromatic-note, (forming part of the Diminished 7th). The natural at D contradicts the leading-note of previous bar, and thus re-asserts the original key (C). In the next bar, at E, the flat is the indication of a new subdominant. It may be observed that the bars marked C and F will be considered later in this chapter.

The appearance of a sharp (or an accidental that *raises*) may generally be taken as a new leading-note, unless it can be shown to be otherwise. The obvious harmony will thus be the Dominant-triad (or an inversion) of the new key.

Similarly the sign of a flat (or accidental that lowers) most commonly stands for a new subdominant, when occurring as an accidental in the melody. In this case treat the top note as a minor seventh, placing beneath a chord of the dominant seventh, or one of its inversions. (See E, in Example 54.)

It must not, therefore, be hastily assumed that every sharp is a leading-note, and every flat a subdominant, though in the majority of cases they may be so treated, in the melody. It is necessary to look well ahead and see if the notes confirm or reject modulation. In the example just quoted, the flat at B can easily be shown not to be the sign of a subdominant, by its chromatic progression.

The cadence at C, namely a full close in G major, might reasonably be inferred from the natural at D, which would be meaningless if the new leading-note (F-sharp) were not still in force, and so requiring correction. The tendency of the melody plainly pointed to a full close in G, which we may express thus: —

(The formula is adapted to the new key.)

$$\frac{4}{5} \quad \frac{2}{5} \quad \frac{1}{1}$$
$$\mathrm{V} \quad \mathrm{V} \quad \mathrm{I}$$

The student will find much assistance if, during the study of modulation in melodies, he analyse airs already harmonized, with a view to observing the cadences. The manner in which, especially in short pieces, every little modulation is at once balanced by a return to the original key (commonly with a half-close), and the alternate use of sharp and flat attendant keys, will impress his mind with a sense of the due proportion observed in the employment of cadences.

In the air by Beethoven (see Example 54) the first point of repose is in the second bar, where we have a dominant chord; another phrase, also of two bars, brings us again to the dominant; then there is a direct modulation to the dominant key (G) which is confirmed by the succeeding two bars. (See A, B, C, of Example 54.)

At the letter D, plainly we return to the original key, and modulate briefly into the key of F, and so on, back to C.

Before parting with the example, it must be pointed out that at the letter F, a natural to the B is understood, by the signature, so that (without accidental) we return to the original key, by means of the half-close.

Analysis of some such kind will prove useful, and the student is recommended to apply it to the Airs (and Variations) of Beethoven and Mozart, which he will find clearly defined, without being trite and obvious, as chants (so often employed) commonly are.

What have been called **Pivot-notes** are much

used in modulation;* that is to say holding-notes which connect the modulation-chords with the old and new keys. For example:—

Example 55. JOSQUIN DE PRÉS.

* "It is good and usual, to change from any one to any other different chord, when any one of the parts keeps its place." (Henry Purcell, "Art of Descant.")

The pivot-note system of modulation lends itself to the most distant removes, as well as to the nearer keys. It may be remarked of modulations, as a whole, that they are govened by the same laws which apply to any succession of harmonies. The nearer ones are bounded by the attendant or related keys. A few examples follow.

Example 56.

An examination of the above examples will show that by means of the perfect cadence (with and without the dominant seventh) all the attendant keys of C major were approached and quitted with ease. As the *new* dominant in each new key is the crucial chord, it is perhaps worth while to tabulate these, without regard (for the present) to the melody. The notation refers to the principal key, in this case C.

Table Showing the Bass-notes of New Dominants for Attendant Keys.

Supertonic Triad (with accidentally raised 3rd) see "A" (in Ex. 56)

Mediant Triad (with accidentally raised 3rd) see "B."

Tonic Triad (with accidental minor seventh) see "C."

Triad on *Leading-note* (with 3rd and 5th accidentally raised) see "D."

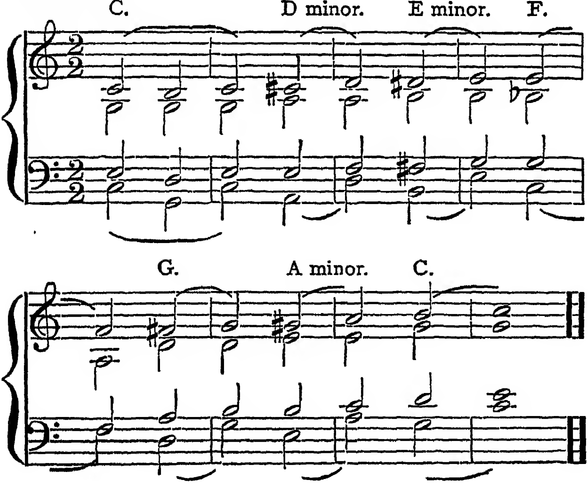
Triad on the *Submediant* (with accidentally raised 3rd) see "E."

The modulations made by these chords were:

C to G, and back to C. (Ex. 56, Letter A.)
C to A minor and back to C. (Letter B.)
C to F and back. (Letter C.)
C to E minor and back. (Letter D.)
C to D minor and back to C. (Letter E.)

It has before been pointed out that an accidental sharp in the melody is generally a new leading-note. This may now be illustrated by an example covering the attendant keys, as before.

Example 57.



As there are three notes to the dominant triad it follows any of these may appear in the treble, or melody As an application of what has gone before, the same cadences leading to the attendant keys may be reduced to a formula. Let it be borne in mind that the upper number refers to the melody, while beneath is given the name of degree of the scale for the bass note, showing the triad to be employed. Where the thirds and fifths are marked in brackets, they refer to the chord, not the scale. It will be seen that each of the notes of the triad appears in the treble in turn, and that in a few cases three numbers are given in the upper part of the resolution.

Modulation to Dominant.

$\frac{\sharp 4}{2}$ to $\frac{5}{5}$; (With raised 3rd.)

$\frac{6}{2}$ to $\frac{7 \text{ or } 5}{5}$; (With raised 3rd.)

$\frac{2}{2}$ to $\frac{2, 5, \text{ or } 7}{5}$. (With raised 3rd.)

To the Relative Minor.

$\frac{\sharp 5}{3}$ to $\frac{6}{6}$;

$\frac{7}{3}$ to $\frac{6 \text{ or } 8}{6}$; (With raised 3rd.)

$\frac{3}{3}$ to $\frac{3, 6, \text{ or } 1}{6}$. (3rd raised.)

To the Key of the Subdominant.*

$\frac{\flat 7}{1}$ to $\frac{6}{4}$;

$\frac{3}{1}$ to $\frac{4 \text{ or } 6}{4}$; ($\flat$7)

$\frac{5}{1}$ to $\frac{4 \text{ or } 6}{4}$; ($\flat$7)

$\frac{8 \text{ or } 1}{1}$ to $\frac{8 \text{ or } 1}{4}$. ($\flat$7)

* The figures refer to the original key (in this case C).

To the Relative Minor of Dominant.

$\frac{\sharp 2}{7}$ to $\frac{3}{3}$; $\frac{\sharp 4}{7}$ to $\frac{3 \text{ or } 5}{3}$;
(5th raised) (3rd raised.)

$\frac{7}{7}$ to $\frac{7, 5, \text{or } 3}{3}$.
(5th and 3rd raised.)

To the Relative Minor of Subdominant.

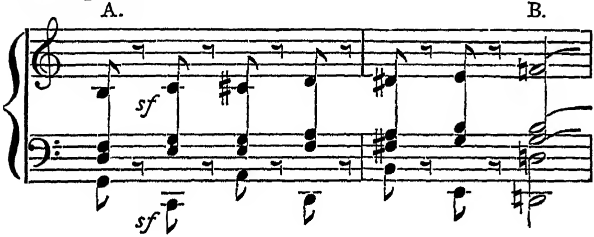
$\frac{\sharp 1}{6}$ to $\frac{2}{2}$; $\frac{3}{6}$ to $\frac{4 \text{ or } 2}{2}$;
(3rd raised.)

$\frac{6}{6}$ to $\frac{6, 4, \text{or } 2}{2}$.
(3rd raised.)

In the foregoing list, the first of each group is the most obvious since the accidental then occurs in the melody (i. e., the upper figure).

In the extract from Beethoven twice previously referred to, the concluding bars of the theme modulate to D minor and E minor, in turn, and thus complete the circle of the attendant keys. (See Example 58.)

Example 58.



The progression at A, if continued, would cover the entire chromatic scale; while the dominant seventh (in its second inversion) at B, shows the class of chord with which to descend. Enough, then, has been said to show that for the purposes of modulation the perfect cadence (with and without the dominant seventh) is of primary importance.

In cases where the accidental flat (or, from a sharp key, a natural) does not indicate a new subdominant, and is not merely a chromatic chord (or passing-note), try if it be a new tonic, or even a minor third from a new tonic. If several accidentals occur in the melody, aim at forming a portion of a scale, with a view to establishing the key; and bear in mind that the new tonic or dominant is likely to be emphasized and attract the attention by its repetition in important parts of the bar.

It should be added that similarly a sharp (or from a flat key a natural) where it is not a new leading-note (or chromatic merely), may be a new major third in its key, which is thus easily discovered; or it may stand for a new tonic or dominant.

The best plan, then, to pursue is to carefully study the progression several notes further than that which puzzles. Above all, study the compositions of the great masters, especially Bach, Beethoven, and Wag-

ner in regard to the practice of modulation, for experience is the only guide to its mastery.*

The selection of examples which follows, serves to emphasize what has already been said. They are chosen more with a view to variety than merely as obvious illustrations of melodic modulation; for this reason the accidentals are commonly not in the upper part, though these would be included in the chords (already tabulated) which lead to the attendant keys, or form new tonics in themselves.

Example 59.

WINCHESTER. THOMAS RAVENSCROFT.

(Melody in the Tenor.)

* A list of masters whose works specially favor the study of modulation can be easily suggested by a teacher using this little work. To the piano-player *Chopin*, to the singer *Schubert*, and to the organist recommend *Bach*.

In the previous example from Ravenscroft may be seen the simple contrivances current in early seventeenth century psalmody. The melody (in accordance with the custom of the day) appears in the tenor. The chords are almost entirely triads In the seventh bar there is an old-fashioned use of a chromatic chord on the seventh degree (flattened) of the scale; this is noticed in our chapter on chromatics. Here it serves to correct the little modulation to the dominant which is seen two bars back.

Example 60.

SCHUBERT.

The brief strain quoted from Schubert is an example of a very simple but astonishingly effective modulation—from the minor to its first flat (attendant) major key. The student of orchestral music will recognize it as the connecting phrase between the first and second subjects of the "Unfinished" Symphony, first movement.

Example 61.

EXTRACT FROM BRIDAL CHORUS.

WAGNER's "Lohengrin."

In our quotation from Lohengrin, a remarkably beautiful modulation is effected in four chords. The third of the major triad employed in the melody is converted into a third of a minor scale, and, after resolution, into a sixth of a major scale. Notice the B-flat forming a pivot, and changing enharmonically, i. e., from B-flat to A-sharp. Observe also the softening influence of the three dominant sevenths, in the second, third, and fourth chords.

Example 62.

EXTRACT FROM HARMONY.

BEETHOVEN.

Our last example of modulation, drawn from Beethoven's treatise on Harmony, shows an enharmonic change in the Bass, where F-sharp (a leading note) becomes G-flat (a submediant); the first chord being in C-minor, and the fourth in B-flat minor. The two chords could of course follow one another as shown at A.

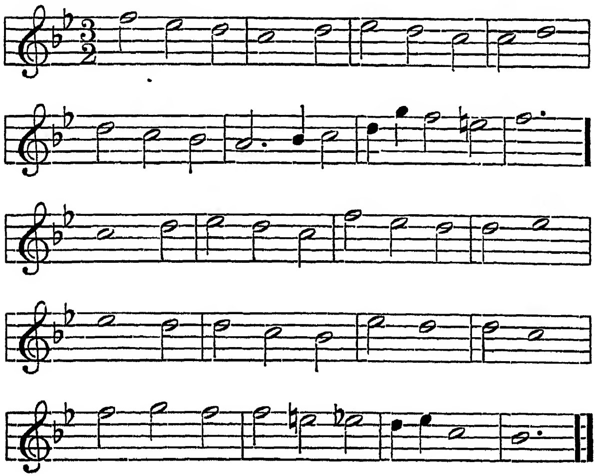
The eleven exercises which follow, contain, for the most part, simple and even obvious opportunities of modulation. The first exercise (No. 45) should be harmonized in three parts only, while the last (No. 55) is intended to be in five-part harmony.

EXERCISE 45.

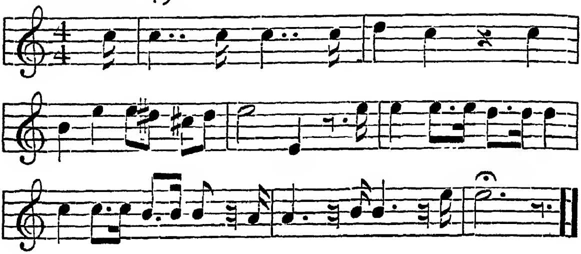
EXERCISE 46.

EXERCISE 47.

EXERCISE 48.



EXERCISE 49.



EXERCISE 50.

EXERCISE 51.

EXERCISE 52.

EXERCISE 53.

EXERCISE 54.

EXERCISE 55.

* The parts may be crossed in bar 5.

CHAPTER V.

PASSING-NOTES—DIATONIC AND CHROMATIC.

Passing-notes have been defined by Sir Hubert Parry as "inessential discordant notes which are interposed between the essential factors of the harmonic structure of music on melodic principles."

As a general rule the student need not provide any special harmony for these ornamental notes, and it only remains for him to detect their presence in order to ignore them.

In passing it may be observed that it is often advisable to answer passing-notes in another part or parts.

The simplest form in which they occur is in passing from one interval of the triad to another. Thus in the chord C, E, G (i. e., the first, third, and fifth of the common triad) there is obvious room for the passing-notes D and F, which may be ignored, as far as the harmony is concerned, in this way: —

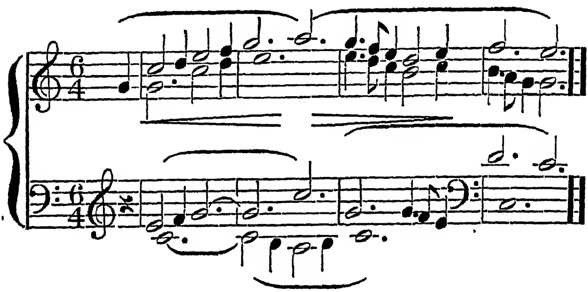
Example 63.

EXTRACT FROM "PARTHENIA."*

* "Parthenia" was one of the names bestowed on Queen Elizabeth; it also stood for an air in Playford's "Introduction" (1655) which Handel appears to have employed as part of the melody of the Pastoral Symphony in the Messiah.

The somewhat bare effect produced by the parts standing still is easily obviated by accompanying the melodic passing-notes with others in the parts; thus: —

Example 64.



As the examples which follow contain other inessential notes, which though not strictly speaking "passing-notes" are nevertheless treated harmonically with the same indifference, it is convenient to include them under the general description.

Example 65.

EXTRACT FROM SEPTET.

Presto. BEETHOVEN.

The two-part example from Beethoven calls for little remark; attention may however be directed to the dissonance caused by the passing-note (in the bass) in the first and second bars on the second beat. In the same bars, a dominant seventh is effectively suggested by the bass (on the third beats).

Example 66.

"VALET WILL ICH DIR GEBEN."

From a Choral Prelude (for Organ).
J. S. Bach.

Bach's Choral Prelude offers us a good example of passing-notes in triplets, and answered in contrary motion. Notice also the mediant pedal, in the bass of the second bar. (See also our chapter on pedals.)

Example 67. From Piano Sonata (Op. 111).

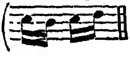
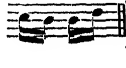
Leggiermente. BEETHOVEN.

In the extract from Beethoven's great movement in the Piano Sonata (Op. 111) one may observe the delicate rhythm which is imparted by the alternation of ornamental notes above and below the primary notes of the melody. Note also the upper part being a diminution of the lower; – not exact, but unmistakable.

Example 68.

EXTRACT FROM THE SONG OF "THE MOORISH PRINCE."

LOEWE.

The simple harmony Loewe has placed beneath his melody throws into relief the quaint little melody which depends so much for its effect upon the use of ornamental and inessential notes. Our brief quotation only permits us one example, which is seen in the group of four quavers, at the third beat of the second bar; where the melody note proper is first delayed and then retarded, by the interposition of the note C — so we get C, B, C, D, in place of the trite B, D. ( instead of )

The use of chromatic passing-notes is well illustrated by the following extract from Chopin's Étude for piano-forte. As the employment of such notes is more common to instrumental than vocal music we need not dwell further on this phase of melodic harmonization, beyond pointing out the extreme simplicity of the example, which has for its harmonic basis the chords written in the lower clef.

Example 69.

EXTRACT FROM GRANDE ÉTUDE, No. 2.

CHOPIN.

Example 70.

EXTRACT FROM FIRST MADRIGAL.

WEELKES (1597.)

Weelkes' First Madrigal gives us an example of a common way of approaching a cadence* with a flattened seventh as ornament (or passing-note) to be immediately contradicted by the natural seventh of the perfect cadence. (See bar two, at the third beat.)

The three succeeding extracts from the Incorporated Society's Book of Melodies, serve to show the use of chromatics generally.

Example 71.

A

B

* Common in Weelkes' day; obsolete in ours.

C

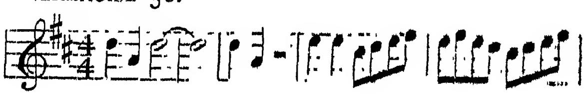
At "A" it is convenient to begin on a sustained pedal-bass, partly owing to the melody suggesting a tonic chord on the first of each of the opening bars, and also because there is enough of change in the three upper parts.

The example at "B" could have had a tonic for the bass of the first bar; it is an advantage, however, to gradually ascend, as shown, to the chord of the sixth on C. In the second bar the melody notes (D-natural and C-flat) should be treated as part of one chord. (See next chapter on arpeggios, etc.). The interval G and F-flat can be taken as shown, with a descending bass, or contained in a chord of the dominant ninth. More will be said on this subject in the chapter on chromatics.

The example at "C" might equally have served as an example of the arpeggio treatment in melodies. In the third bar this is especially obvious, where the four notes B flat, E flat, G and B-flat of the melody also supply the chord placed beneath.

The exercises which follow contain various opportunities for the introduction of passing-notes—diatonic and chromatic.

Exercise 56.



EXERCISE 57.—(Add an Alto and Bass.)

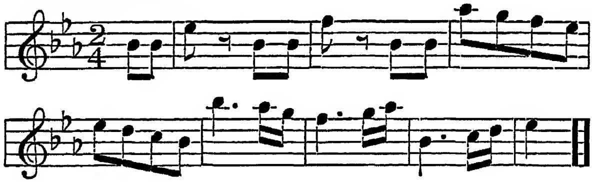
EXERCISE 58.—(Add three parts.)

EXERCISE 59.

EXERCISE 60.

EXERCISE 61.

EXERCISE 62.



EXERCISE 63.

EXERCISE 64.—(Melody in the Tenor.)

EXERCISE 65.

EXERCISE 66.

CHAPTER VI.

ARPEGGI.

Arpeggi as applied to melody form the subject to be considered in this chapter.

As each triad has three notes, it is commonly convenient, if the melody ring the changes on the three, to keep one harmony for the series, such harmony being most probably the original triad. With the addition of the dominant seventh, and ninth, and other such chords, any interval of the scale can be contained, in such a manner as to cause no unnecessary movement in the sublying harmonies. This will prove a great help in the harmonization of melodies, especially in places where the melody skips much or rapidly.

The great use of arpeggi in the harmonization of melodies will probably ere this have occurred to the student. Everywhere is he confronted with them in practical composition; whether he take up the Chromatic Fantasia of Bach, the First Sonata or the "Appassionata" of Beethoven, or such works as "Parsifal" Vorspiel, or the remarkable example in "Das Rheingold" (see bars 1–67). There is no limit to the examples scattered through the pages of the masters both old and new. Here we confine ourselves to a few remarks on the use of arpeggi, and their necessary illustrations and exercises.

Example 72.

"WHY ASKE YOU."

From the Fitzwilliam Virginal Book. GILES FARNABY

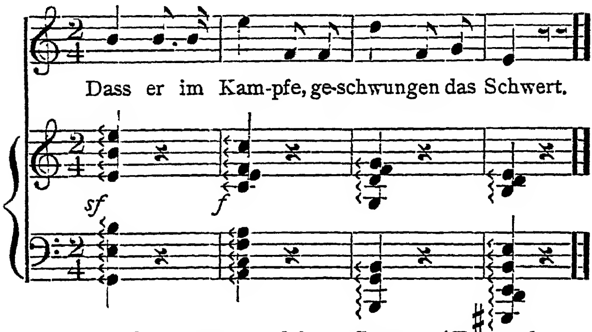
The little piece of harmony copied from the Virginal book (Example 72) serves to illustrate what has just been said. The wide skips are supported by chords containing such melody notes. It would be very difficult to improve upon the harmonization of the four last bars, especially in three parts, though it must not be overlooked that the style is instrumental rather than vocal.

Note that each bar needs but one chord to support the air,

Example 73.

EXTRACT FROM "THE MOORISH PRINCE."

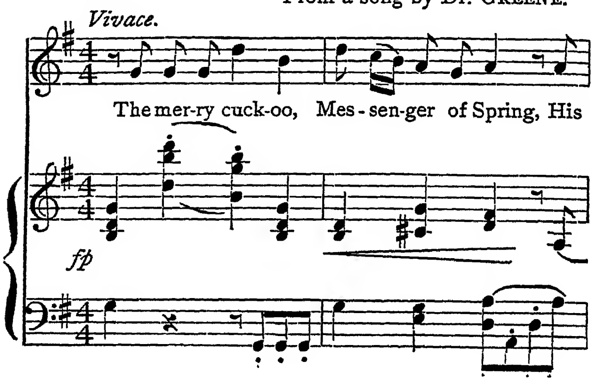
LOEWE.



The four bars extracted from Loewe (Example 73) offer a still less promising group of intervals, until by the same method of harmony we perceive that they are merely portions of chords which quite naturally fall into their place when so treated.

Example 74.

From a song by Dr. GREENE.



Dr. Greene furnishes us with a melody which, if accompanied by the pianoforte, might be treated as above. It will be observed that in order to avoid the monotony of mere chords, these, like the melody itself, are broken up into arpeggi, in imitation of the air.

Syncopation can often be treated successfully by the methods previously shown. In its other aspects, involving suspensions, retardations, etc., this subject will recur.. See Chapter XI.

THE CARMEN'S WHISTLE.

Example 75. WM. BYRDE.

It may be pointed out that with one exception all the syncopated notes also form part of the chord from which they move. Byrde avoids monotony by a change of harmony wherever the melody admits of time and opportunity. Written with tied notes, as suggested below, the example needs no further comment.

Example 76.

The selection of exercises given below includes many passages which the student will do well to treat as arpeggi, though here, as in other cases, the melody will be found possible for other methods of harmonization. The exercises are to be worked in four-part vocal harmony. In the last of these (No. 74) the syncopation occurring in the melody should be noted, before working the exercise.

Exercise 67.

Exercise 68.

EXERCISE 69.

EXERCISE 70.

EXERCISE 71.

EXERCISE 72.

EXERCISE 73.

EXERCISE 74.

CHAPTER VII.

SEQUENCES.

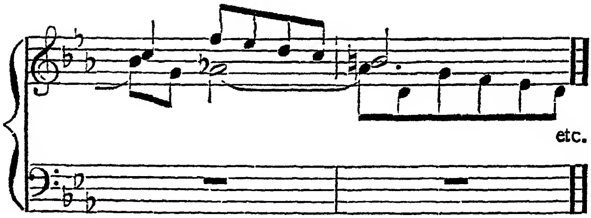
Sequences play an important part both in melodies and in their harmonization, and may now be usefully touched upon. "A Sequence," says Sir Hubert Parry, "is generally taken to mean the repetition of a definite group of notes or chords in different positions of the scale, like regular steps ascending or descending." As regards their application to melodies, the student must first trace his sequence in the melody, and then test his harmonies that they follow exactly where the melody leads. That is to say, if the melody offers a phrase which is repeated a step or two, higher or lower, the harmonies are to be also contrived in such a manner that relatively they may go through the same process. Example is better than precept in this particular matter.

It must not be presumed from the above that sequences are always to be exact. It is the perception of them which should be the student's first care. Many beautiful effects may afterwards be obtained by varying the replies in sequences. Modern composers especially favour this method. The older writers more usually preserved their sequences literally.

Example 77.

EXTRACT FROM A FUGUE.

RINCK.

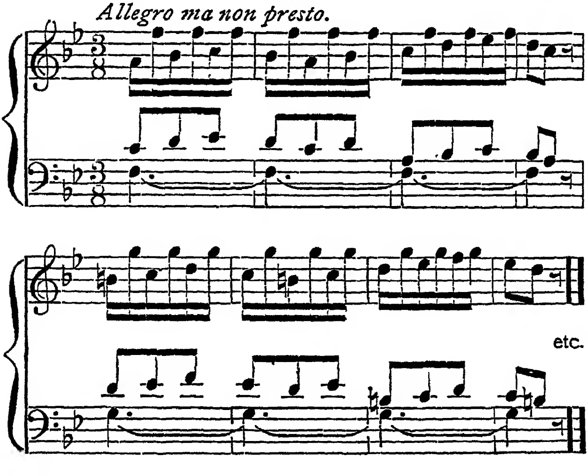


The little two-part quotation from Rinck (Example 77) shows an exact following out of the sequence. For further examples of this kind the student should turn to his Bach, where, especially among the Organ Fugues, he will not need to seek far to meet interesting sequences exactly carried out.

Example 78.

EXTRACT FROM CONCERTO No. 2 (FOR ORGAN).

HANDEL.



The example from Handel's famous Organ Concerto (Example 78) practically confirms what has already been remarked. Among the same composer's harpsichord pieces are many passages built up on this principle, which is of course (as all good principles are) still in vogue.

Example 79.

EXTRACT FROM "STABAT MATER."

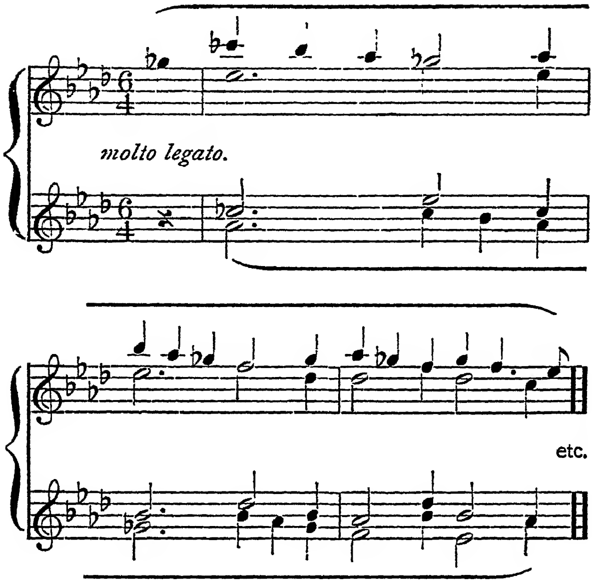
More modern instances are now offered, by way of example. Dvorak's opening bars (Example 79) do not give us an exact sequence, which would scarcely be practicable. The last four bars, however, are sequentially accurate.

* The consecutives between bars 5 and 6 are not for imitation.

Example 80.

EXTRACT FROM "PARSIFAL."

WAGNER.



Wagner's "Parsifal" is full of instances of exact sequences. That we quote (Example 80) appears in a variety of forms in the course of the work, which the student will do well to study for himself. Among modern writers Schumann seems to have employed the sequence more than most. Grieg, following presumably in his steps, has employed the device with great success. The chromatic passages employed in sequence by Wagner, notably in "Tristan," can only be briefly mentioned here. In the chapter on chromatics more will be said on the subject.

A few exercises are added which favour the carrying out of passages in sequence.

EXERCISE 75.—(In three parts only.)

EXERCISE 76.—(In four parts.)

EXERCISE 77.

EXERCISE 78.

EXERCISE 79.

EXERCISE 80.

CHAPTER VIII.

CHROMATICS.

THE treatment of chromatic notes in any given melody involves either the use of mere chromatic *passing* (or inessential) *notes*, *chromatic chords*, or *modulation*. Much of the ground has been already traversed in Chapters IV and V. Some further examples of melodic chromatics are now offered. In perusing them the student should carefully observe the manner in which the chromatics chiefly fall in the unimportant pulsations of the bar. The true harmony is thus asserted while the ornamental melody prevents it from becoming dull.

Example 81.

EXTRACT FROM "CALVARY."

SPOHR.

With two chords as his harmonic basis, tonic and dominant, and maintaining a tonic pedal, Spohr (in Example 81) takes us through the chief part of the chromatic scale of A minor. The melodic notes falling on the first beat of each bar may be taken note of; namely I, V, I, V, I, while the third of the scale occurs in the middle of the alternate bars.

Example 82.

EXTRACT FROM NOCTURNE (No. 5).

FIELD.

Field's example offers a harmonization, in one chord, namely the tonic, of the chromatic scale of B-flat major, one note being wanted in the melody to make it complete, i. e., the 4th, E-flat. The initial note of each group of three falls thus in the melody;— 1, sharp 5, 7, 9, and thus shows an advance on the previous example.

Example 83.

EXTRACT FROM "FAUST."

BERLIOZ.

Berlioz makes striking use of the interval of a tritone, in the first bar of Example 83. It may be explained as an appoggiatura (see Vincent's "Harmony," page 138) or the supertonic 11th in its third inversion, or it may even be explained as a triple pedal with a free part above. The whole passage is instructive as a perfect example of how melodic chromatics may be ignored.

Example 84.

EXTRACT FROM "NONET."

SPOHR.

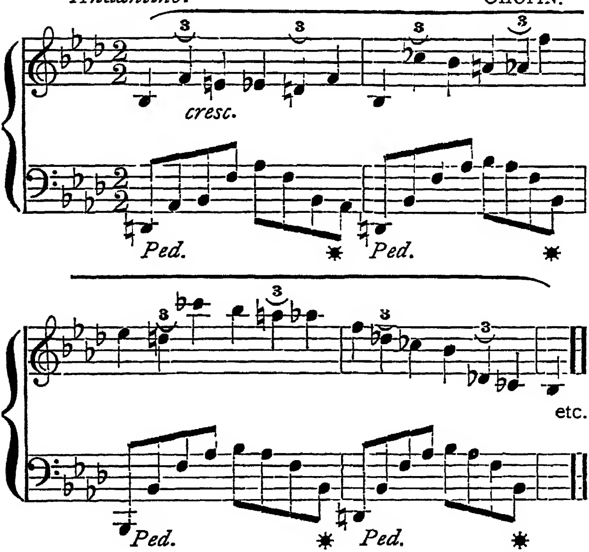
Example 84, from Spohr's "Nonet," offers a simple instance of the effect of skipping from a chromatic passing-note. This is clearly brought about by each of the melody notes of the first of the bar being an appoggiatura. (See Vincent's "Harmony," page 161.)

Example 85.

EXTRACT FROM AN ÉTUDE.

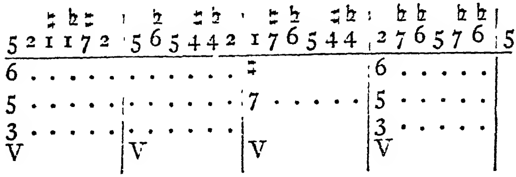
(*Trois Nouvelles Études, No. 1.*)

Andantino. CHOPIN.



Example 85 offers a more elaborate succession of chromatics, all of which are harmonized with a simple dominant chord (in E-flat minor). The notes belonging to the harmony may be profitably set down.

The upper figures give the degrees of the scale; the lower show the harmony in the ordinary way.



It may perhaps be added that the pianoforte, for which the passage was contrived, offers an exceptionally good medium for the employment of rapidly changing melodics above a chordal bass, assisted by the sostenuto pedal. Observe, (in bar 4,) the raised leading-note of bass, with flat 7th in the treble. Compare Example 152.

Two exercises follow. These should be quite simply harmonized with one chord to each group of three notes. Here and there the inner parts might also have a chromatic passing-note introduced.

Exercise 81.

Exercise 82.

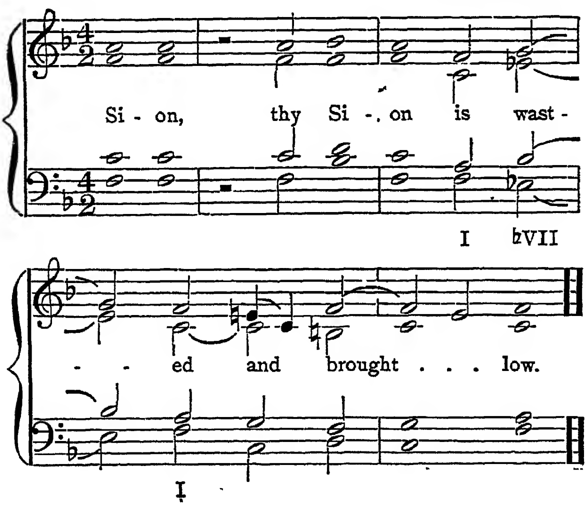
Chromatic Chords.

We now enter upon the consideration of placing **chromatic chords** beneath given melodies. The power of doing this effectively will only be gained after careful study and comparison of good models. Chromatics are naturally weak in comparison with the diatonic chords, which therefore must still form the basis of any good harmony.

The major triad on a chromatically lowered leading-note may be instanced as one of the earliest chromatic chords put to systematic use. The discovery no doubt arose from the attempt to employ the church scales in conjunction with harmony. For a complete list of the chromatic triads, the student may be referred to Dr. Vincent's Harmony, page 117.

Example 86.

WM. BYRDE.



The progression quoted above (Example 86) was quite usual in Byrde's day; namely, the harmonies I–♭VII–I. More usual modern treatment of such a chromatic chord will be seen in Example 89, (p. 108).

Example 87.

Air from the Fitzwilliam Virginal Book. | Arranged by WILLIAM BYRDE.

Our quotation from the Fitzwilliam Virginal Book (Example 87) shows that this chromatic progression was by no means confined to church music, as may be gathered from the similar succession of chords, —vi–♭VII–I— cited from a popular Elizabethan song.

Example 88.

From the Fitzwilliam Folio. FRANCESCO FEROCI.

Feroci's little three-part passage (Example 88) gives an illustration of how the same chromatic chord may be quitted in a smoother and — from a modern point of view, perhaps — a more satisfactory manner. This is managed by treating the ♭VII as a new subdominant and dwelling on it for a brief moment. The final destination is the same in all three examples, namely a return to the key of the tonic.

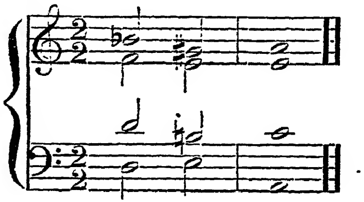
Example 89.

EXTRACT FROM "THE MASTERSINGERS."

Wagner's is the only modern example (No. 89) for which we have space. It will be seen that the progression is but slightly varied from the older ones; as thus — I–♭VII–IV–II–I–V–I. The effect of the II following the IV serves to show the advance we have made in the general *balance* of harmony. It may be noted that few effects ever become obsolete.

The Pathetic Cadence supplies another instance of a chromatic chord which in all likelihood arose from the ancient combinations given us in the ecclesiastical "Phrygian," or the Greek Doric mode.

Example 90.



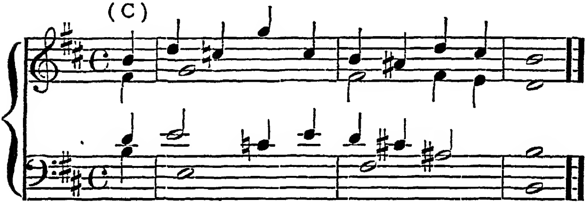
The chord alluded to is the first of the above series, and is of course known as the **Neapolitan Sixth.** It was used long before the time of Bach. More modern instances, unfortunately too long for quotation, may be found in the first movement of the "Moonlight Sonata" of Beethoven, and in the chief motive in Dvorak's "Requiem."

The following phrases are drawn from the Incorporated Society's book of Melodies, and serve to show the appearance the cadence will make in examination papers.

Example 91. (A)

(B)

(C)



It will be observed that in each of the three phrases quoted the pathetic cadence is somewhat disguised in the melodic notes given; the general treatment of the harmony should easily adapt itself to the altered conditions, as shown.

One of the most important of the chromatic chords is the **Diminished Seventh,** which it is convenient to refer to the dominant ninth as its original position. The various resolutions of the diminished seventh and its power to proceed up or down chromatically invest it with peculiar powers of inviting or resisting modulation. For more precise details of these chords than our examples and notes admit of the pupil is referred to Dr. Vincent's "Harmony," pages 139 and 148.

Example 92.

Our 92d example gives a **Dominant Minor Ninth** as a *chromatic* chord, for the passage is in C major. Each bar emphasizes the minor ninth, which, however, ends as it began, in the major key. Attention may be drawn to the chromatic descent of the melody in the third bar, which is answered in the succeeding bar by a lower part having a similar progression.

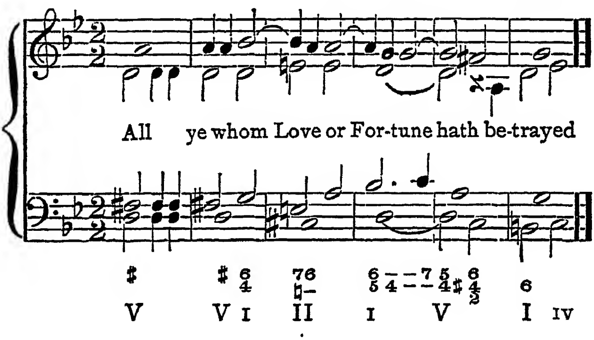
Example 93. BEETHOVEN. (Op. 2, No. 1.)

Example 93 shows all the intervals of the chord of the dominant minor ninth successively introduced in the upper part on a dominant bass. The chord is emphasized (in bar 3 of the quotation) by the three-part harmony, which it may be noted is the fewest number of parts capable of giving a clear effect of the dominant ninth.

Example 94.

EXTRACT FROM "ALL YE WHOM LOVE."

JOHN DOWLAND. (1597.)

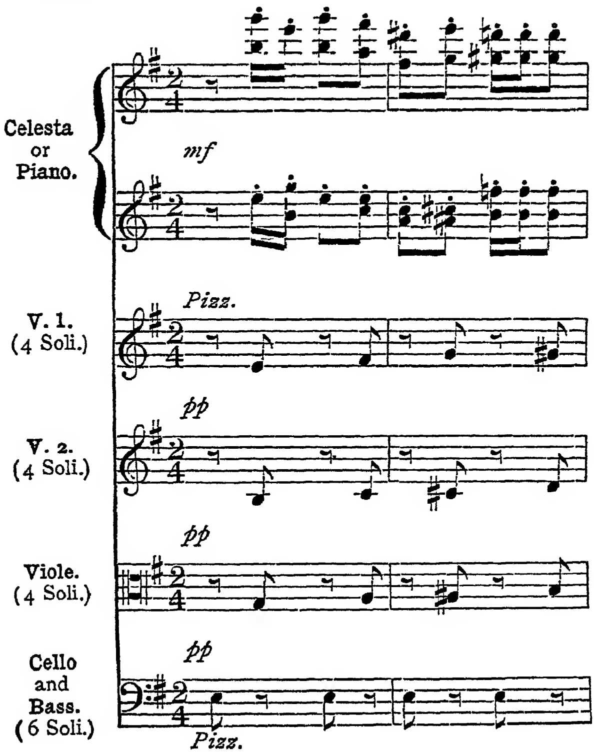


The Diminished Seventh.

It has already been remarked that one of the most important of the early chromatic chords is supplied in the first inversion of the minor ninth, which is distinguished by a separate designation — **the Diminished Seventh.** In the sixteenth century

specimen quoted from Dowland (Example 94, bar 3) the seventh itself is carefully prepared, and the bass moves cautiously to the fundamental chromatic (C-sharp). Other examples will be seen in the Appendix to this volume.

Example 95. TSCHAIKOWSKY.



In the 95th example, by Tschaikowsky, there is a favourable specimen of the freedom of the diminished sevenths, four of which succeed one another in a rising passage * of chromatics, on a pedal bass. It will be observed that the passage ends as it began on the tonic (E minor).

By a simple experiment the student will find that he can construct diminished sevenths on each degree of the chromatic scale, and though as an occasional effect this may be done in practical harmony, as hinted in the last example, such a succession is rarely effective, and therefore better avoided. On the other hand, by the judicious interposition of a triad (or inversion) alternate diminished sevenths become at once attractive and useful.

* Notice the progression of the *String* parts.

Example 96.

FROM THE BALLAD OF "EDWARD."

LOEWE.

Agitato.

Loewe's example (No. 96) contains two diminished sevenths (marked at A and B), and the bass for the first three bars may be taken as a pedal on the tonic, E-flat minor. If otherwise regarded, the second chord in the example may be taken as a flat-supertonic seventh,* prepared. Lastly, the same chord may be explained as a chord of the thir-

* In its third inversion.

teenth, formed on G-flat, with its root, third and fifth all omitted. Before parting with the example, which is certainly a curious one, it may also be observed that in the last bar, the note G-flat, in the melody, (written small) is to be regarded as the thirteenth of a dominant chord from root B-flat, or as a mere retardation of a note contained in the previous chord.

Example 97.

KYRIE.

From the Fitzwilliam Folio. LEONARDO LEO.
(1694–1746.)


e e-le-i-son, Ky-ri-e e-le-i-
son, e-le - - - - i-son.

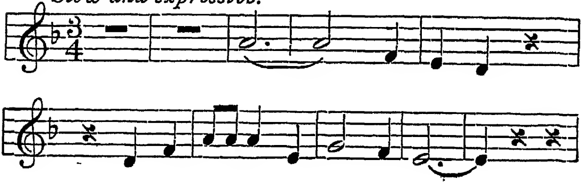
The five-part example (No. 97), by Leonardo Leo, shows an expressive piece of harmony, in which the diminished seventh plays an important part, occurring as it does no less than five times. In the last two bars leading to a dominant close, a pedal again makes its appearance. With this example and a few exercises for working, we close the chapter, though other chromatic chords remain to be noticed.

EXERCISE 83.

EXERCISE 84.—Melody in the Tenor.

EXERCISE 85.

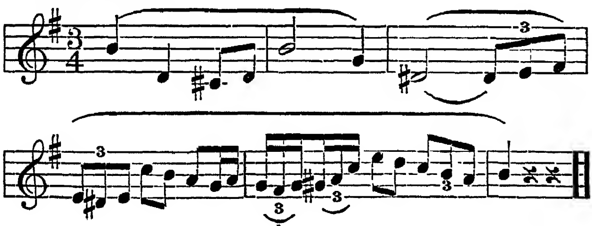
Slow and expressive.



EXERCISE 86.

EXERCISE 87.

EXERCISE 88.



CHAPTER IX.

THE AUGMENTED SIXTH AND THE AUGMENTED TRIAD.

THE chord of the **Augmented Sixth,** with its many possibilities as regards melody, came into popular use in the 17th century.

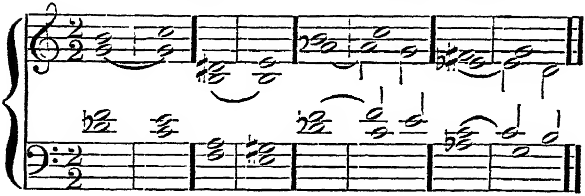
A simple chromatic alteration of one note in the chord of the 6th on the supertonic or the subdominant produces the primary form of this harmonic combination, known as **the Italian Sixth.**

Example 98.

The tendency of the *flattened* note to fall and of the *sharpened* note to rise, is significant of the ordinary resolutions of these extreme intervals. With the addition of a 4th, or the substitution of a 5th, two other forms of the same chord are obtained. These are given without their several inversions, which, however, the student should write out for himself.

Example 99.

The French Sixth. The German Sixth.



It will be seen in the above example (No. 99) that the **French form** of the chord has a useful pivot-note in the 4th of the 6–4–3, while the German form has a 5th which must on no account follow the bass, unless at a safe distance, on account of the fifths, which would otherwise result. In practice, it will be found that the **German form** of this chord is the most useful.

The system by which a double root (or first and second generator) was claimed for this chord is out of favour; but as it is instructive, at least, to note what was formerly considered an important matter, the two roots are shown in the first example (No. 98).

"In the case of the augmented sixth on the flat second of the key, there is only one note to be altered; and as that note is constantly altered in this fashion in other combinations—namely by substituting the flattened note, as D-flat for D in the key of C, by Carissimi, Bach, Beethoven, Chopin, in all ages of harmonic music—it seems superfluous to consider whether or no it is a chord with a double root as theorists propose, in which one note is the minor ninth of one root, and the other the major third of another." (Sir Hubert Parry.)

Our first historical example (No. 100) is from a manuscript written between 1650–1656, that is, during the composer's life time. In the second bar the augmented sixth is prepared by the previous chord—an augmented triad. In the printed version of

Lawes' "Ayres" (1653), the passage is modified into a mere diatonic passage. a third part added, and the barring of the song much altered. (See Example 26.)

Example 100.

"COME, CHLORIS."

(A DUET.)

From the rare Guise MS.
(British Museum, circa 1650.)
Add. MSS. 11,608 fol. 8b.

HENRY LAWES.
(1595–1662.)

Purcell does not appear to have employed the chord to any very great extent, although his predecessors Carissimi and Pelham Humphrey both set an example. The quotation is from "Dido and Aeneas" (1675), and shows an effective employment of the Italian form of the chord, the voice-part proceeding from one note of the chord to another.

Example 101.

EXTRACT FROM "DIDO AND AENEAS."

PURCELL. (1675.)

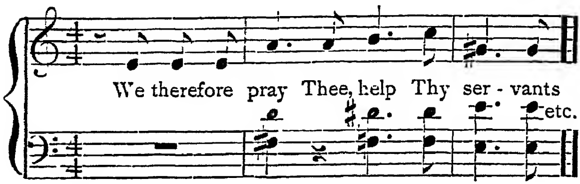
The three-part example (No. 102), from the same composer, shows the chord changing from the French to the German form, by means of the melody rising a step. The resolution is also to be noted as being unusual in vocal writing. The passage is from Sir Frederick Bridge's new edition of the great "Te Deum,"* page 15. Mention may also be made of another example in the same work at page 21, just before the letter "T."

* Published by Novello & Co.

Example 102.

EXTRACT FROM "TE DEUM."

PURCELL.



The student will find many splendid instances of the employment of this chromatic chord in the works of Bach, for which we have unfortunately no space. His attention is also directed to the remarkable movement of Beethoven, which begins with the augmented sixth, as shown in the four opening bars quoted below. (Example 103.)

Example 103.

BEETHOVEN. (Op. 78.)

A modern use of the same chord in a rapid melodic passage for pianoforte shows how characteristic is the simplest suggestion of the augmented sixth in the hands of a master. (Example 104.)

For a completer view of this chord and its inversions, reference should be made to Dr. Vincent's "Harmony," pages 121–133.

Example 104.

BRAHMS.
Presto, ma non troppo. (Op. 35, Bk. 2, Var. 14.)

Our final illustration of the chord under discussion shows how the whole chromatic scale may be covered by a succession of augmented sixths. Thus grouped together, it must be borne in mind that they have not time to make much effect; * and care must be taken not to introduce too many or too rapidly. Beneath each of the chords a small group is given. showing the original position and, in some cases, the enharmonic equivalent. (Example 105.)

EXERCISE 89.—Play over, or write out, the same passage, with all the augmented sixths altered to diminished sevenths, at one time the favourite substitute for the more modern combination written.

* Because of their conflicting tonality.

Example 105.—A succession of Augmented Sixths.

The Augmented Triad.

For the convenience of classification, theorists usually include the chord known as the **Augmented Triad** among the combinations arising from the chord of the thirteenth. Thus the chord so built up from any tonic will give the augmented triad by the simple process of taking the root, the third, and the *minor* 13th, ignoring the other intervals. Long

before such classification was thought of, the augmented triad was in common use. It can be traced back to the sixteenth century, as some of our examples will serve to show.

An entirely chromatic application of the chord is seen in the third bar of Example 106 where, as D minor is not established, the passage must be held to be in the key of F. The composer evidently felt the curiously harsh, biting effect of the combination, judging from the words he illustrates. The modern custom would be against emphasizing the C-natural (doubled by the tenor) on account of rendering the tonality uncertain. The note of the melody derives piquancy from this particular harmony in no other way to be obtained.

Example 106. RICHARD EDWARDS. (1523–1566.)

It seems not unlikely that the next example (No. 107, at bar 4) gives a good idea of the manner in which the augmented triad was first used. The cautious way in which the bass approaches the leading-note B-natural, with the three upper parts all tied, suggests strongly the old contrapuntal methods of Dowland's immediate predecessors. In the fifth bar an augmented triad is produced by the alto moving to E-flat as an anticipation. This again is in accordance with ancient custom.

Example 107.

EXTRACT FROM "GO, CRYSTAL TEARS."

From The First Set of Songs. (1597.) JOHN DOWLAND. (1562–1625.)

Another example from Dowland (No. 108) proves that even in the sixteenth century composers had discovered that the augmented triad need not of necessity be prepared. At the second bar of Example

108 all the parts are in motion to meet the chromatic chord which is introduced with considerable emphasis, not to say pungency. (See *.)

Example 108.

EXTRACT FROM "UNQUIET THOUGHTS."

First Book of Songs. (1597.) JOHN DOWLAND.

The three-part example, No. 109, of William Webb (a contemporary of Lawes) gives the augmented triad in its first inversion, approached by skip, as far as the melody is concerned. The two lower parts, it will be seen, descend gradually in sixths. There are further examples in the book from which the quotation is drawn.

The fifths between tenor and bass, in bar 3, are very harmless.

Example 109.

FROM PLAYFORD'S "SELECT AYRES."

WILLIAM WEBB.

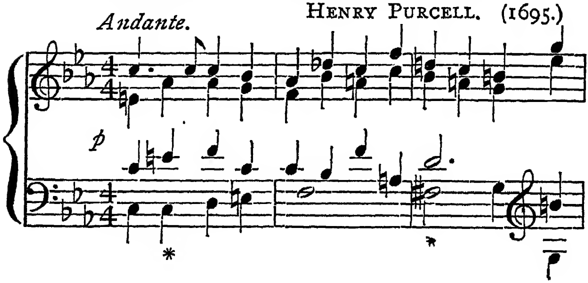
(Bk. III, p. 18. 1653.)

No less than four chromatic triads occur in the little piece taken from Purcell's "Bonduca," (Example 110). These are marked with an asterisk. (*) The whole passage goes plainly to prove what has been pointed out by the late Sir George Macfarren, that Purcell did not use chromatic *passing-notes* to any extent, though he employed chromatic *chords* freely enough. Taken alone more than one part reads as (chromatic) passing-notes; but these being *combined* plain chords result.

Example 110.

FROM THE OVERTURE TO "BONDUCA."

HENRY PURCELL. (1695.)



It is no doubt a wide leap to the art of Richard Wagner, but in Example 111, the same chord under consideration is exhibited in its second inversion, the passage being entirely in the key of G-flat. Note should be taken of the progression of the bass, which descends chromatically, and resolves the augmented fifth itself (D-natural) chromatically, that is, on the note D-flat. The voice part omitted is not essential to a correct understanding of the harmonic structure.

Example 111.

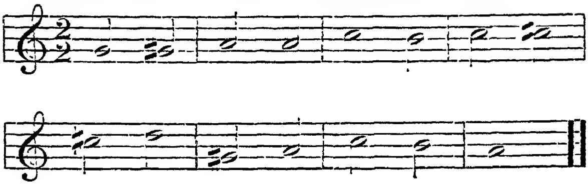
EXTRACT FROM "PARSIFAL." *

WAGNER.

In the exercises which follow, the student should find little difficulty in introducing the two chords discussed in this chapter. If he does, he should proceed to make out a table for himself, showing what degrees of the melody are available for harmonization by the aid of these two chords;—viz;—the augmented sixth and the augmented triad. The resolutions of the sharp note should be also marked. With such a table before him he may then proceed to the exercises.

* Page 18, Kleinmichel's Score.

EXERCISE 90.—On the Augmented Triad.



EXERCISE 91.—On the Augmented Triad.

EXERCISE 92.—On the Augmented Sixth.

EXERCISE 93.—On the Augmented Sixth.

EXERCISE 94.

EXERCISE 95.—On both Chords.

EXERCISE 96.—On both Chords.

CHAPTER X.

FURTHER STUDY OF CADENCES.

THE simpler forms of **Cadences** have already been considered. Some of those which follow are no less simple if their ornamental dress be removed; others, however, are rarer forms which are of great historic value, if obsolete.

Example 112, copied from the Fitzwilliam Virginal Book, shows a procedure common enough in the Elizabethan period, that is, the attempt to finish an air with the *dominant* cadence. It may be added that not only the *air* had such cadences, but they were retained throughout the series of *variations*, and finally employed in the ending; thus producing a feeling of unrest and instability which doubtless led to their being discarded.

Example 112.

HANSKIN.

"JOG ON, JOG ON THE FOOT-PATH WAY."

From the Fitzwilliam Virginal Book. Version by RICHARD FARNABY.

The fine old harmonization of Byrde (No. 113), copied from the same source, gives an instance of an uncommon use of the plagal cadence in the last bar. The harmonic basis of the example is extremely simple, and may be read thus:—

Bars 1 and 2	Tonic.
Bars 3 and 4	Supertonic.
Bar 5	Subdominant.
Bar 6	Tonic.
Bar 7	Dominant.
Last bar	Tonic.

Example 113.

THE HUNT'S UP.

("Pescodd Time.")

From the Fitzwilliam Virginal Book.

Version by WILLIAM BYRDE.

Lasso's example (No. 114) offers a varied form of the plagal cadence, in which the melody takes the unexpected progression seen in the two final chords; apparently this is brought about by the desire to introduce the interval of a third in each of the two chords, in which only three voices are available. Between bars 2 and 3 observe also the "interrupted" cadence;—i. e., dominant harmony proceeding (*not* to tonic) but to submediant.

Example 114.

EXTRACT FROM THE MOTET, "SICUT ABLACTATUS EST."

FITZWILLIAM. ORLANDO DI LASSO.

Another and almost modern use of the plagal cadence occurs in our quotation of Willaert's Motet, (Example 115), a composition of the time of Henry VIII. There are two exceptions to modern practice, which may be pointed out in passing. Between the treble and tenor, in bar 1, 7ths occur, produced by the odd suspension in the lower of the two parts; and in bar 2, the leading-note is doubled. Both details would be amended in modern practice.

Example 115.

FROM MOTET "QUEM DICUNT HOMINES."

ADRIAN WILLAERT.
(1480–1562)

Almost every form of cadence occurs in Bach. The one we quote (Example 116) illustrates the rare employment of a plagal cadence in the minor *without* tierce de Picardie.

Example 116.

FROM "TOCCATA ET FUGA" IN D MINOR.

BACH.

Example 117, "Norwich Tune," from Ravens croft's Psalter, is a harmonization by John Milton the father of the poet, and an accomplished musi cian. The final cadence is particularly well con trived, with its *tierce de Picardie;* and apart from the harsh (false) relation in bar 3, there is little that would not pass muster in our own day.*

Example 117.

NORWICH TUNE.

(RAVENSCROFT'S Psalter, 1621.) JOHN MILTON.
(Psalme 102).

*The 8ves between treble and bass (bars 7 and 8) should perhaps be excepted.

The close connection of the tonic minor and major is more evident in theory than in practice; though it must be admitted that in many of Schubert's Songs practical illustration of the real affinity of the two keys may easily be found. In the following example (No. 118) copied from Orpheus Britannicus (1695), Purcell shows how the master hand of the 17th century could combine with the utmost delicacy these fundamentally similar, but practically conflicting keys.*

Example 118. HENRY PURCELL.

*See page 43 (par. 66), Dr. Vincent's "Harmony."

Our last illustration of unusual cadences (No. 119) is drawn from "Tristan and Isolde," a work which abounds in fine examples of the kind. The novel way in which a perfect close is given by the chorus — here represented by the upper staff — while the orchestra (lower staff) enters with a chromatic effect produced by the use of an augmented triad, gives the impression of an interrupted cadence, probably an invention of Wagner.

Example 119.
EXTRACT FROM "TRISTAN AND ISOLDE."

For obvious reasons the chapter concluded does not necessitate direct exercises upon it. The opportunity is therefore taken to give a set of six exercises bearing generally on the matter which has gone before, without inviting the use of extraordinary cadences.

EXERCISE 97.

Exercise 98.

Exercise 99.

EXERCISE 100.

EXERCISE 101.

EXERCISE 102.

CHAPTER XI.

SUSPENSIONS, PEDALS, etc.

Suspensions have already been admitted in the course of numerous examples; only brief reference will therefore here be made. From the point of view of melody, a suspension is generally recognized by its being a "tied-note" which *falls*. The interposition of one note need not prevent the suspension if the fall finally takes place. Retardations and suspensions were originally synonymous, so that a passage of sixths by the retardation of the top part became a series of suspended sevenths. The first step in the development of the suspension was the introduction of a different chord beneath the resolution.

The student is warned *not* to use a suspension of a note together *with* such a note. The quotation from Dowland (Example 120) illustrates what is meant. Such discordances are better left alone. In the famous Canon of Tallis (Example 121) effective instances of the suspension occur in the opening bars. The "ties" are shown by the dotted lines.

Example 120.

JOHN DOWLAND.

Example 121.

"PRAISE THE LORD, O YEE GENTILES."

Canon " two parts in one."

RAVENSCROFT. THOMAS TALLIS.

This old form of Tallis's Canon is of simple harmonization. Note, however, the fifths in bar 2, and the unusual suspension (in the bass) at bar 4.

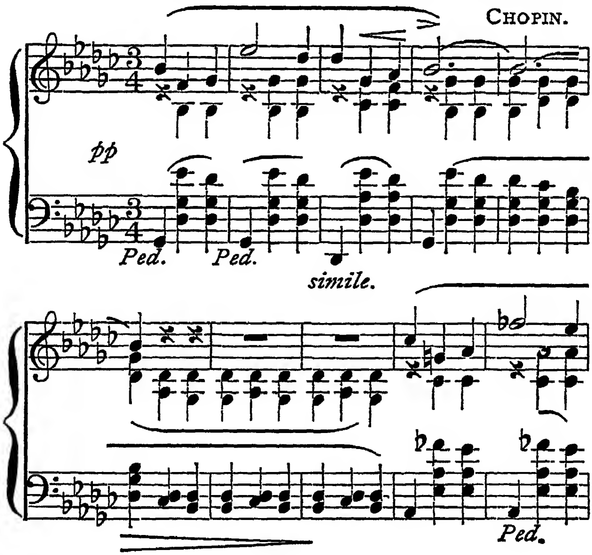
A short collection of examples of the employment of **Pedals** will tend to show how a single note, properly introduced and quitted, may be sustained at

any length with widely diverging harmonies heard simultaneously. Such a note is "properly introduced" by any chord of which it is an integral part, and the same condition should be observed at the end of its duration. The early instance quoted from Hucbald in our Preface should be examined in this connection. (See page iv).

The extract from Chopin (Example 122) gives a simple tonic pedal for the two opening bars, then a dominant, and, more uncommon than these, a mediant pedal in the upper part (see bars 4, 5 and 6.) The same passage is repeated, in sequence, one step higher.

Example 122.

EXTRACT FROM SONATA IN B-FLAT MINOR.



The three-part example from Cesti (No. 123) shows the use of a pedal on the sixth of the major scale, the other parts flowing quite naturally but freely to the half-close.

Example 123.

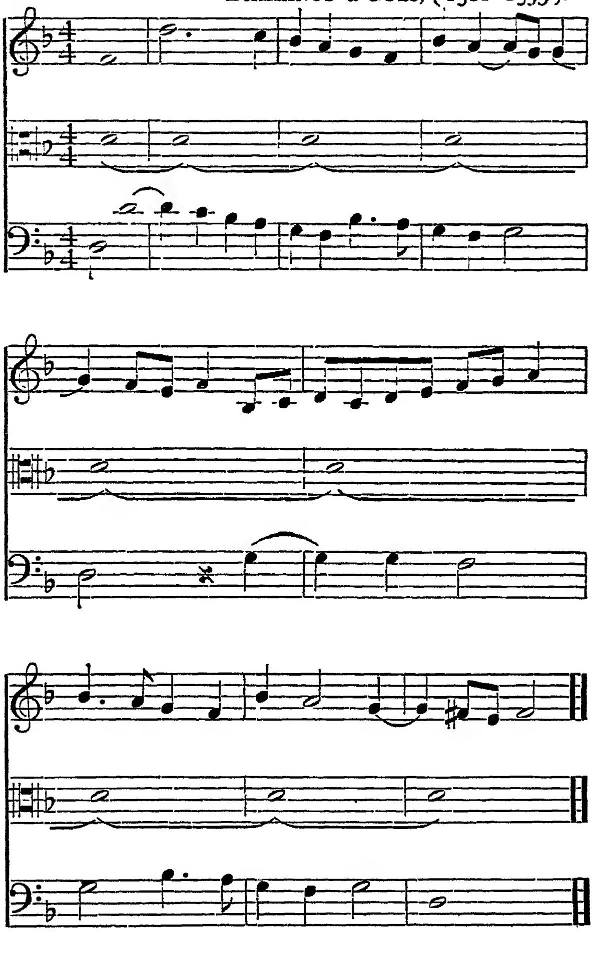
MARC ANTONIO CESTI.

Goës' * example (No. 124) an early sixteenth century composition, introduces us to a tonic minor pedal sustained with much ingenuity in the middle part. The tierce de Picardie occurs in the final bar.

* A Portuguese amateur of great musical distinction. See Hawkins' "History."

Example 124.

DAMIANUS à GOËS, (1501–1553).



We give below (Example 125) a specimen of that very unusual phenomenon,—a leading-note pedal. (See the second half of bar 2, in the bass.) The whole passage is worth study, the imitation being extremely effective and melodious. The passage might equally well have appeared in our chapter on passing-notes.

Example 125.

EXTRACT FROM THE FUGUE IN B (No. 23).

Forty-eight Preludes and Fugues.

J. S. BACH.

NOTE.—A fine instance of the capabilities of a pedal with rapidly changing harmonies is seen in the Second Ballade (for Piano) of Brahms. The passage is too long for quotation here. But students are recommended to peruse the second part of the piece marked "*molto staccato leggiero*" and twenty bars onwards.

Though there is still a chapter to follow dealing with melodies set in examination papers, a selection of more or less knotty problems treated practically, we have now traversed all the ground necessary for an intelligent understanding of our subject. Some would perhaps expect a chapter on the elevenths and thirteenths, compound chords, if we may so call them, or in place of these, a more elaborate consideration of the sevenths. I may refer all such to Dr. Vincent's "Harmony," pages 81–115, where these matters are fully discussed. Nor is there space for a proper study of imitation, which in actual practice is so very necessary for elegant part-writing. One example, however, may be given (No. 126) in lieu of precept. The theme (in tenor) supplies the rest of the material which surrounds it; that is to say, that the phrases employed in the other parts are derived from the theme and employed in imitation. For this particular class of music the student is referred to the Choral Preludes of Bach, which not only contain exquisite workmanship, but also the most expressive music ever designed for the organ.

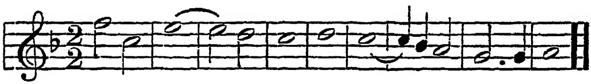
***Example 126.** E. DUNCAN.

* From a Prelude in F (Vincent Music Co.).


(Theme.)
etc.

A selection of exercises is offered by way of conclusion, bearing on what has gone before in the same manner as those given at the end of the last chapter. In a few of them the special opportunity for pedals, imitation or suspension is indicated. The remainder may be taken as supplementary exercises on general harmony.

EXERCISE 103.—Add two parts introducing suspensions.



EXERCISE 104.—Introduce imitation.

EXERCISE 105.—Introduce imitation.

EXERCISE 106.—Introduce imitation.

EXERCISE 107.

EXERCISE 108.

EXERCISE 109.

EXERCISE 110.

CHAPTER XII.

EXAMINATION PAPER MELODIES.

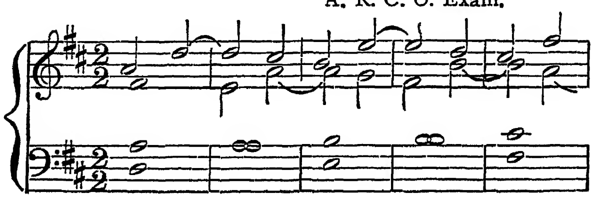
Extracts and Adaptations of Melodies from some of the leading Examination papers of the Universities and Musical Colleges.— In order to derive the utmost benefit from the following examples, the student is recommended first of all to copy out the melody (each in its turn), then study it, and work it out; and finally to compare the details of his working with the version here given. It is not to be expected that the two versions will literally agree, since the same melody always admits of several kinds of harmonization.

[Note on Example 127.]

The two opening bars of melody give a plain hint of suspension; answered in sequence, one step higher, in the third and fourth succeeding bars. Let the parts strictly maintain the sequence, as long as possible. The treble phrase invites an imitation, which is perhaps most easily managed by the alto. The chords used are all triads and sixths, which are always favourable to the introduction of simple suspensions, such as the 4 3; the 7 6. In the penultimate bar (No. 9) the minim in the treble is a disguised suspension. Had it been written as a tied-crotchet its treatment would have been more obvious.

Example 127.—Melody given.

Adapted from a paper set for the A. R. C. O. Exam.



The melody of this example (No. 128) was set at a prominent examination some years ago, and like others of its kind appears to present difficulties not usually met with. Thus the sustained note at the end for three bars requires exceptional treatment, as few melodies conclude in this manner. The figure at the beginning seems awkward to harmonize, owing to the return to the tonic, at bar 2. A closer examination of the initial phrase will show that the principal notes are numbers 1, 5, and 4, the two quavers having the appearance of an ornamental resolution of the 5th. At first sight the submediant seems the best bass, unless indeed we keep a pedal for the two opening bars, which is rarely an effective or vigorous harmony in the beginning of a piece. Look at the treble of bar 2. It reads 1, 4 (4 2) 3. The 1 and 4 make answer to the 1 and 5 of the first bar. Better include each of the two notes in one chord, so the 1 to 4 will be a form of the subdominant, just as the first chord will be the tonic. It will now be seen that we still require a chord for the second part of bar 1. Let it be the dominant, because that will lead easily to the subdominant of bar 2, and also because it is an effective progression (in contrary motion) from the tonic. In bar 5 the harmonies of the same figure are very properly varied. Two endings are given, each making use of the figures suggested by the treble. In cases where the final note is much prolonged, it should be assumed that the other parts must continue, in spite of the restrictions imposed by the melodic pedal, for such the holding-note in reality becomes. The plagal cadence should at once suggest itself as having a treble note (No. 1) common to both its chords. The best way, however, is, as in our example, to take some characteristic phrase from the melody and weave it into some simple variation of the subdominant and tonic chords, taking care not to stray too far away from the end, which is so near at hand.

Example 128. — Melody. A. R. C. O., 1882.

Alternative ending.

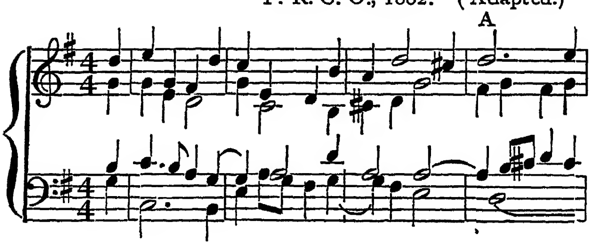
The minor melody which we have worked (No. 129) may be taken as a fair specimen of the more advanced class, calling for considerable care in the treatment of details. So marked a figure as that announced in the melody of bar 1, should be carefully noted for reproduction where opportunity offers. The eighth bar and the two following give such an opportunity, and a very easy one; for we may fill them in as we choose, providing only we are ready to take up the melody again for the final bars (Nos. 11 and 12). Now as the melody breaks off and resumes on the dominant, it will be an obvious plan to maintain such a harmony as will suite both tags of the same, namely a dominant pedal; which is what has been done. The remaining details are already covered by previous remarks on parallel examples.

Example 129. F. R. C. O., 1882.
(Adapted.)

The salient features of the melody at No. 130 may be summed up in briefer fashion. The wide skips in the opening bars must on no account be imitated in the harmony. Let them be included in the chords chosen, so that the E and G (of bar 1) form part of the same triad, and only a little movement be allowed the next pair of notes, namely F-sharp and D. Two methods are given of treating the fourth and fifth bars, both equally natural. (See A and B.) Care must be had that the last four bars be not too monotonous. The descending scale of melody sets a hint for the kind of movement to be maintained, for maintained it certainly must be, while the G semibreve is at rest. Moreover the full close must not be thought of until the penultimate bar (No. 12). Lastly it is advisable to keep the movement going during that bar, as shown.

Example 130.

F. R. C. O., 1882. (Adapted.)



(*Alternative.*)

The special features of Example 131, another melody harmonized, lie in the hitting off in an effective manner the chromatics, and the observance of the sequence in bar 9, and the preservation of some sensible movement in the three last bars. At any rate these are the objects aimed at. Let the student always endeavour, during any pause in the melody, to introduce material such as chromatics, passing-notes, or any characteristic phrase that will keep the interist alive during the passiveness of the melody.

Example 131.

F. R. C. O., 1882. (Adapted.)

The harmonization presented in No. 132 bears out the recommendation given in the last comment made on the previous example. The features are here all strongly marked. From the start imitation should commend itself, while at bar 4 the melodic phrase offers a ready opportunity for reproduction, in a modified form, in the very next bar.

Example 132.— Add three parts to the Melody given.

London Mus. Bac.

The melody drawn from The Incorporated Society's Book (and here presented in harmony, No. 133, by permission), in spite of numerous chromatics has but a simple harmonic basis. Thus the bars 1 and 2 begin and end on a tonic foundation, while the tenor voice-part accompanies the melody in its chromatic course; this is quite naturally balanced by the progress of the two succeeding bars (3 and 4) being practically founded on the dominant. Care must be

taken in the final bars of such a piece. After the sluggish harmonies employed, movement of a more determined kind was called for. This is imparted by the rapidly changing chords of the two concluding bars.

Example 133.

INCORPORATED SOCIETY MELODY, No. 647.

By permission.

Our final example (No. 134) is fittingly chosen from a paper set for what is perhaps the most coveted musical degree in the world, namely the Oxford Doctorate. Strictly speaking such an example is rather contrapuntal than melodic, though the subjects have much in common. The theme granted appears in the part assigned the viola, and, round this, suitable harmony (an addition of five parts) was called for, which might suit stringed instruments.

Little need be said in further explanation of the aim of the example, which is less complicated than some of those that have gone before, despite its six parts. In the course of the work, recommendation has been made of the practice of harmonizing melodies placed in the tenor. All the simpler melodies used in this work might be put to such employ; as in the principal examinations some such exercise is always called for.

Oxford Mus. Doc.

Add five parts to the viola (second) part given: so that there will be 2 violins, 2 violas, and 2 'cellos. Mark the phrasing and bowing.

Example 134.

APPENDIX.

The Appendix of examples which follows should help to further illustrate the gradual growth of Harmony, which is also *one* with the *Harmonization of Melodies.* No attempt has been made to follow the actual chronology, which is more usefully preserved in the histories of Hawkins and Burney, to which all thorough students of the subject of Harmony must finally go. What little history incidentally arises in the paragraphs here given, it is hoped will tend to brighten the study of the examples and encourage a desire for fuller knowledge, if not for individual research.

Although the 13th century Round—"Sumer is icumen in"—has often been quoted as the earliest known specimen of harmony, a few anterior examples exist Those of native origin are mostly collected and reproduced in facsimile in the pages of *Early English Harmony*, edited by Professor Wooldridge for the Plainsong and Mediæval Music Society. Others, almost equally ancient, of continental origin, may be found in Coussemaker's "L'Harmonie Au Moyen Age," and elsewhere. Such antique specimens, however interesting, are scarcely of direct practical use to the modern student. Only a few fragmentary examples, such as those drawn from 15th century carols (Example 38, etc.) are therefore included in these pages.

Byrde and other writers of the Elizabethan day claim our attention until we reach the period of Dowland, late 16th century. Henry Lawes and after him Henry Purcell lead us forward to the light of the 18th century, after which it would appear we must turn to other countries for examples of what music at its best can show, though native art has been by no means idle. The following table of dates will enable the student to take a rapid survey of the periods to which our examples refer.

A comparative table showing the dates of the composers of the examples, English and foreign.

				Hucbald	840–930	(circa)
Dunstable (John)	(circa)	1400–1453		Josquin de Prés	1450–1521	(circa)
Henry VIII		1491–1547		Mouton (Jean)	1475 1522	
Tallis (Thomas)		1520–1585		Willaert (Adrian)	1480–1562	
Edwards (Richard)		1523–1566		Goës	1501–1553	
Byrde (Wm.)		1538–1623		Lasso	1532–1594	
Farnaby (Giles)		1560–1600	(circa)			
Dowland (John)		1562–1626		Monteverde	1567–1643	
Weelkes (Thomas)		1570–1620	(circa)			
Ravenscroft (Thomas)		1582–1635				
Lawes (H.)		1595–1662				
Webb (William)		1605–1665				
Milton (John)		1590–1646		Feroci		
Playford (John)		1623–1693		Cesti	1620–1669	
Purcell (Henry)		1658–1695		Stradella	1641–1681	
Greene (Maurice)		1696–1755		Bach	1685–1750	

		Handel	1685–1759
		Leo	1694–1746
		Rinck	1770–1846
		Beethoven	1770–1827
Field (John)	1782–1837	Spohr	1784–1859
		Loewe	1796–1869
		Schubert	1797–1828
Goss (Sir John)	1800–1880	Berlioz	1803–1869
		Schumann	1810–1856
		Brahms	1833–1897
		Wagner	1813–1883
		Tschaikowsky	1840–1893
		Dvorak	1841–1904

Example 135.
From a MS. roll in the Library
of Trinity College, Cambridge. 15th Century.

The above example (No. 135) is a fair specimen of 15th century three-part harmony.* Thirds were omitted, passing-notes were clashed together, and the whole structure was considered rather from a melodic or contrapuntal point of view than as harmony in our sense of the word. The cadence, it may be added, was a usual one of the period, and curiously enough ends with 7, 6, 8 as the melody-

* All the flats, and the sharp, are absent in the M.S.

notes. The accompanying alto notes, hopeless as they look, are correctly transcribed.

Example 136.

"O MY HEART."
(A Song for Three Voices.)
HENRY VIII. (1491–1547.)
From a Manuscript in the British Museum.

Little apology is needed for the introduction of a piece of composition of so august origin, and I believe, hitherto unprinted. The student will note with amusement the free use of consecutives in bar 2. The air, however, is not without merit; nor indeed is the harmony.

Example 137.

PAWLES WHARFE.

From the Fitzwilliam Virginal Book.

GILES FARNABY. (Circa 1560–1600.)

Farnaby's excellent harmony (Example 137) might well have been cited as an early example employing an unprepared dominant seventh, (see last note of second bar in the melody). It is also rich in passing-notes. The tenor part in bar 4 quaintly enough passes through the *minor* 7th of the scale. Compare also bars 6 and 7, where C-natural is similarly used. There is scarcely a brighter little melody within the compass of these pages, and the rhythm is far from common.*

Example 138. WAGNER.

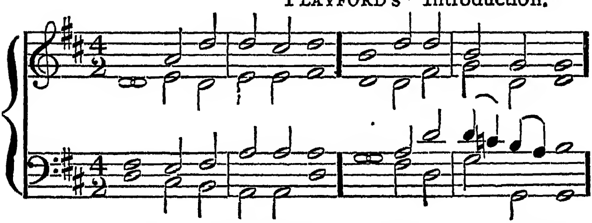
The chords of the above example (No. 138) would easily pass for an old-fashioned progression; nevertheless the student may find them on page 226 of Kleinmichel's score of "Parsifal."

Example 139.

"PROPER TUNE."

(Psalm 148.)

PLAYFORD'S "Introduction."



*The quaint effect of the C *natural* in the bass of bar 6, and the consecutive 5ths in the last bar may be noted.

The "Proper Tune" set to the 148th Psalm (Example 139) is remarkable for the singular alternation of the tonic and subdominant closes, which occupy the whole piece. Note also the arpeggio-like opening of the melody. In slow music it is not satisfactory to treat such notes as part of the same chord. Better vary it slightly, as shown, keeping the bass near at hand, and avoiding any wide movement in any part, as the treble skips so prominently. The third and fourth bars, though emphasizing the subdominant chord, do not permit of any use of the perfect cadence to the subdominant; the tenor is therefore made to hint at the *missing* chord, (a minor 7th on D), by means of passing-notes. The endings of the lines give

the cadences in the following order: — Tonic,
Subdominant,
Tonic,
Subdominant,
Tonic,
Tonic,—
a truly remarkable (and monotonous) list.

Example 140.

OXFORD TUNE.

(Psalm 4.)

From "An Introduction to the Skill of Musick."

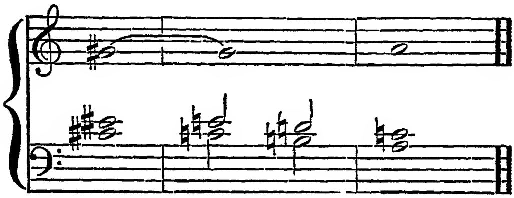
JOHN PLAYFORD.

Playford's "Introduction" yields us an example of an old tune harmonized throughout with triads (Example 140). The beginning on a leading-note was by no means uncommon as regards the melody of old pieces. Immediately following will be found a modernization of the same air, in chromatic harmony, made by the editor in the manner of Grieg, if it be not presumption to say so. (See Example 141.)

Example 141.—In Chromatic harmony.

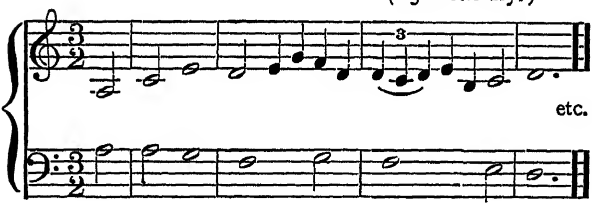
OXFORD TUNE.

The opening is founded on the mediant triad (with major 3rd) of the *tonic major* scale. The sudden modulation to A minor, with no note in common, is comprehended by examining the following extension of the same thing.



Example 142.

From the Oxford version
of the Agincourt Song.
(15th century.)



The next two examples may be taken in connection with the chapter on passing-notes. The "Oxford" version of the Agincourt song contains the bars quoted at No. 142. The second bar actually contains a dominant seventh, unprepared, though it is brought about by the singular use of ornamental notes shown.

Example 143.

A CATCH FOR THREE VOICES.

DEUTEROMELIA. (1609.)

Three blind mice, etc.

This venerable fragment of harmony (Example 143) is copied from Ravenscroft's wonderful old collection, entitled "Deuteromelia" (1609). To read the little melody aright, we must begin at the figure 1, then turn back to 2, and lastly take the top line as the completion of the melody. The quaint effect of *no third*, in the 3rd chord of each bar, must not be overlooked.

Example 144.

STRADELLA.
(1645–1681.)

The common origin of the minor seventh and the diminished seventh on the subdominant, it is pointed out by Sir Hubert Parry, is seen in the example above given from Stradella (No. 154). See bars 2 and 5. A much earlier use of the diminished 7th has already been given in Example 94, by Dowland. Two more instances are here added (Nos. 145 and 146) from Purcell's "Art of Descant" (1683.)*

(Art of Descant).

Example 145. PURCELL.

Example 146. PURCELL.

* The *figures* are quoted exactly.

Purcell, in the essay alluded to in our last paragraph, speaks of "two discords, the sharp seventh and flat seventh mightily in use among the Italian masters," (see our example No. 145, chords 2 and 8). Example 146 is interesting as well for the unprepared diminished 7th (in bar 2) as for the Neapolitan 6th, an early instance, in the very first bar.

Example 147.

EXTRACT FROM "AWAY WITH THESE SELF-LOVING LADS."

JOHN DOWLAND. (1597.)

Modulation in the 16th century was of an extremely cautious nature as a rule. Exceptional cases like the preceding (Example 147) can, however, be found, especially in English compositions of the period.

Our last quotation is from Schubert, and shows a beautiful and striking progression (Example 148), which has been justly declared by Professor Prout to be one of the "most beautiful and novel ever written." In all probability this is its first appearance, though no one need be surprised if it be discovered in Bach. It is also perhaps of little consequence who first used the progression; for those who can use it well will not be in danger of being accused of anything more than the common indebtedness which the old masters themselves had for their forerunners. Dvorak's use of the same modulation is also added. (Example 149.)

Example 148.

EXTRACT FROM SYMPHONY IN C MAJOR.

SCHUBERT.

Example 149.

EXTRACT FROM "SPECTRE'S BRIDE."

DVORAK.

THE END.

INDEX.

Dr. Smith Woodward's conclusion that the skull requires the establishment of a new genus in the family Hominidæ. If so, it represents another sifting out, another blind alley, another breaking of the mould in which a wonderful creation was cast. For the early Briton of the Sussex Weald was no ancestor of ours.

We must include in our conception of our race the fact of solemn antiquity, and the fact that we had distant relatives who came to nothing although possessed of very high qualities. For one of the interesting conclusions at which Dr. Keith has arrived, after painstaking reconstruction of the data, is that the Piltdown brain was well within the modern human standard of size. And this was at the Pleistocene period or earlier, perhaps half a million years ago. "All the essential features of the brain of modern man are to be seen in the brain cast. There are some which must be regarded as primitive. There can be no doubt that it is built on exactly the same lines as our modern brain."

"Although our knowledge of the human brain is limited—there are large areas to which we can assign no definite function—we may rest assured that a brain which was shaped in a mould so similar to our own was one which responded to the outside world as ours does. Piltdown man saw, heard, felt, thought, and dreamt much as we do still. If the eoliths found in the same bed of gravel were his handiwork, then we can also say he had made a great stride towards that state which has culminated in the inventive civilisation of the modern western world" (Keith, 1915, p. 429). There is something awe-inspiring in the fact of the coming and going of *tentative men*—of Java, Neanderthal, and Piltdown—who had their day and ceased to be, creatures not unlike ourselves, but with more clay in their legs, our predecessors

but not our ancestors. Was Emerson thinking of this sort of thing when he wrote:

> "Thrice I have moulded an image,
> And thrice outstretched my hand,
> Made one of day, and one of night,
> And one of the salt sea sand."

After the segregation of the branches represented by Pithecanthropus the erect, the slouching man of Neanderthal and Heidelberg, and the fine-brained Piltdown man, there was left the stem of modern man, which broke up in Pleistocene times into African, Australian, Mongolian, and European races. It is possible that the modern man type was distinguishable from collaterals a million years ago. If we mean by the antiquity of man the time since he reached what may be called the human standard in size of brain, Dr. Keith's conclusion is that this was reached by the commencement of the Pliocene period, which means over a million years ago. When the evidence of flints is considered, the tendency is to go further back still.

There may be errors in the conclusions of the authorities whom we have followed, and the estimates of time are very uncertain, but there is no great likelihood of errors which will affect the general impressions that alone concern us here. The antiquity of man is on a grand scale. There is a solemnity in the patience of the age-long man-ward adventure which has crowned the evolutionary process upon the earth. Three million of years ago the Primate stem sent out its first tentative branches, and the result was a tangle of monkeys; æons passed and the main stem, still probing its way, gave off the Anthropoids, which certainly rise to great heights. There was no pause, however, yet without hurry other experiments

were made, and the terminations of these we know at Trinil and Heidelberg and Piltdown, for none of them lasted or was made perfect. Still the main line goes on evolving—and who will be bold enough to limit its insurgence? Is there a race of super-men implicit amongst us who will, when another half million years have sped, look back on us as we on the early Troglodytes? In any case it seems, to say the least, extremely difficult to look back on the sublime spectacle of long-drawn-out trial and error, patience and endeavour, and on the general progressiveness of the issue, without the hypothesis (which other than scientific considerations may make more than a hypothesis) of an inherent purpose as the core of the world-process. But to suppose that the purpose is fulfilled in *us* in particular, who are but stages in an evolving race, seems premature.

§ 3. *Man's Solidarity with the Primate Stock.*

Zoology speaks with no uncertain voice in regard to Man's affiliation to the Mammals. There is "an all-pervading similitude of structure", as Sir Richard Owen said, between man and the anthropoid apes; his blood mingles harmoniously with theirs; he and they share certain diseases. Moreover, man is a walking museum of vestigial structures, which prove his pedigree; and he is shot through with atavistic proclivities. In his development he climbs, to some extent at least, up his own genealogical tree. There is no doubt at all that Man is solidary with the rest of creation. To quote the closing words of *The Descent of Man:* "We must, however, acknowledge, as it seems to me, that man, with all his noble qualities, with sympathy which feels for the most debased, with benevolence which extends not only to other men, but to the humblest living creature, with his

God-like intellect, which has penetrated into the movements and constitution of the solar system—with all these exalted powers—man still bears in his bodily frame the indelible stamp of his lowly origin."

The Psalmist felt Man's insignificance, "When I consider the heavens, the work of thy fingers, the moon and the stars which Thou hast ordained,—What is man?" Subsequent astronomers from Copernicus onwards had taught the same humbling lesson; but it was reserved for the biologists to expose the pit whence Man had been digged, and the rock whence he had been hewn by proving his solidarity with mammals. But this is only one side of the picture.

§ 4. *Man's Unique Position.*

Mankind has often had to pay for the realisation of a great truth by temporarily losing grip of some other. Dazzled by a new conclusion, we are blinded to an old one. Thus, without being reactionary, we may ask whether we have not paid heavily for the truth that is in Darwinism. That truth, as regards Man, was the recognition of his solidarity with the rest of creation, of his definite affiliation to a primitive stock of Primate mammals, of his literal blood-relationship to the relatively distant collateral stock of Anthropoids. It has made the world more a universe to have seen the worm, as Emerson said, mount through all the spires of form, striving to be Man. It has given a new significance to the realm of organisms, with all its groaning and travailing, that the man-child glorious was born of them, bone of their bone, and flesh of their flesh. It has been a clearing of the eyes to know that much that used to seem quite inexplicable and bitterly perplexing in

us is a succession tax on our inheritance, a lien that the past dwelling in us exacts. It has been a heartening encouragement to know that it is an ascent, not a descent, that we have behind us, and that if we read the story aright the Cosmos is rather with us than against us. The recognition of our solidarity with the realm of organisms has been of great importance, and we cannot go back on it. Yet it has perhaps blurred our appreciation of Man's apartness.

What, then, are the differentiating characteristics of Man that mark him as a being unique and apart? The bipedal uprightness may have had something to do with human speech, and there is undoubtedly interest in various structural peculiarities from chin to heel (taking both these words with anatomical literalness), and from teeth to great toe, but there is little that we can regard as decisive save the size and complexity of the brain, of the cerebral cortex in particular. No normal human subject has less than twice the cranial capacity of say the orang or chimpanzee; the average human brain weighs far more than twice the heaviest gorilla brain. The closely convoluted cerebral cortex, about a foot and a half square if folded out, is composed of some 9,000 millions of cells, and is the protoplasmic side of Man's capacity for forming general ideas and experimenting with them (in what we call reason), his power of rational discourse or language, his vivid self-consciousness of himself as a personality with a history behind him, and with strong kin-instincts binding him for his own self-realisation to his fellows.

We lose what Darwin has gained for us if we fail to recognise that many animals seem to have a power of perceptual (though probably not of conceptual) inference; that many animals have words though they do not make sentences

(perhaps they would speak more if they had more to say); and that there are animal societies at various levels of differentiation and integration. Rousseau's saying, "Man did not make society, Society made man", may be taken to cover the fact of pre-human anthropoid sociality. As Mr. Hobhouse says, "We find the basis for a social organisation of life already laid in the animal nature of man." But allowing all this and more, we are constrained to admit that Man stands to a remarkable degree apart, and that prehuman evolutionary formulæ no longer quite fit.

The theromorphists, who see in Man only a bipedal mammal, are wont to point to children, with their delicious primitiveness of gait and speech, of manners and morals, and with their largely pre-intellectual thought-stream in which the world is "one great booming buzzing confusion"; but while such facts strengthen our conviction of Man's affiliation with mammals, they do not affect our impression of his apartness when a fully developed personality.

We probably err, as Sir Arthur Mitchell never tired of insisting, in dwelling too much on degraded savages, for when we wish to get the truest appreciation of any type we should study its fullest expression, and some at least of the degraded savages are probably in process of retrogression, being the descendants of the under-par remnants of tribes sifted or persecuted too severely. Furthermore, many unsophisticated people take a good deal of knowing and are not quick to lay bare their souls either to missionary or scientific ethnologist.

But our point is the simple one that Man at his best—who reasons and thinks about his thinking, who bends Nature to his will, who seeks after the True, the Beautiful, and the Good with all his heart and soul and strength—is a being

singularly apart. As Mr. Hewlett says in his *Richard Yea-and-Nay:* "'Lord, what is man?' cried the Psalmist in his dejection. 'Lord, what is man not?' cry we, who know more of him?"

As the 'self-made' man is proud to show the cottage where he was born, so generic man may take credit to himself in contrasting his present position with his 'humble origin'. He must be very self-complacent, however, if he has no feeling of gratitude in respect of—we cannot say to —those simple creatures without whom he would be yet more imperfect than he is. For while many know the handicap of inherited animal passions sometimes asserting themselves all too vehemently, and of humbling atavisms that come to the surface occasionally from the deep undercurrent of the Unconscious, can there be forgetfulness of the plus side of our inheritance, the deep instincts of kinship, of mutual aid, of love, and of parenthood whose roots go far back into the pre-human world. We must be very careful, too, in inquiring into the accuracy of the statements that are made in regard to what is supposed to be carried on from mammals to men.

The truth lies between two extremes. It is erroneous, on the one hand, to regard man as isolated and the great exception, as "a moral Melchizedek, without father, without mother", and as one who to save his soul must combat the 'cosmic process'. For this overlooks the fact of solidarity, and raises the gratuitous problem how a moral being can have emerged from non-moral or immoral antecedents. It is erroneous, on the other hand, and a fallacious biologism to think that human evolution can be scientifically handled without a recognition of Man as a rational and social personality, pre-eminent even on the average, at his best—and

then usually in the form of a woman—" a little lower than the angels, crowned with glory and honour". "What a piece of work is a man! How noble in reason! How infinite in faculty! in form and moving how express and admirable! in action how like an angel! in apprehension how like a God!"

§ 5. *Factors in the Ascent of Man.*

Of the factors in the establishment of human species we are very ignorant, and even speculation has not much to say. Sir Ray Lankester has called attention to the interesting fact that in Miocene times there was a great increase in the size of the brain in several mammal types, such as the Elephants. This may have implied that differentiation of the rest of the bodily system could not profitably go much further. There may also have been some potent environmental stimulation. The possession of a big brain meant great power of profiting by experience, of 'educability', and it would seem that several hundreds of thousands of years ago Man's brain was not far from the standard of historical times, standing head and shoulders above the rest of creation in resourcefulness. But what led to the big brain we do not know. Was there a gradual summation of small increments in intelligence and the like,—here a wrinkle and there a wrinkle in the cerebral cortex, or was there a brusque mutation such as is hinted at in the occasional emergence, in the brief span of historical times, of geniuses, like Aristotle, Archimedes, Shakespeare, and Newton? As regards the big brain, it seems not unlikely that there is shrewdness in Robert Chambers's suggestion that a prolongation of the ante-natal life may have had to do with the big brain, just as the prolonged infancy, characteristic

of human offspring, would help in the growth of gentleness. The lengthening of the period of gestation would not of itself mean much in the way of racial advance unless we believe that it could as it were repercuss on the germinal organisation. But it would mean much if there was at the same time a germinal variation in the direction of an enlarged brain. Great importance, as we have seen, is to be attached to 'temporal variations' which consist in altering the 'time' of different periods in the life-cycle, lengthening out here and shortening down there; and the prolongation of youth, also characteristic of mankind and of many very clever mammals, means, as Dr. Chalmers Mitchell has well shown, giving time for breaking down instincts and replacing them by remembered results of experiment, for proving all things, for tentatives in self-expression. It is a significant fact that "Man's brain is only about one-fifth of its adult weight at birth, that of the anthropoid is already two-thirds. . . . By the end of the second year the human brain has reached two-thirds of its adult size, it has then reached the same relative degree of development that the anthropoid has reached at birth" (Keith, *The Human Body,* p. 37).

Consideration must also be given to the possible result of walking erect, of using sticks and stones, of making beds and shelters, of living in families and co-operating socially, of talking a good deal. And all these are illustrated among Primates lower than Man. The Anthropoid Apes are not social creatures, but it must be borne in mind that many of the lower Primates are. There is the raw material of social organisation at many a level among mammals, and there are springs of good conduct, too, which no one need be ashamed to have inherited.

We are ignorant of the factors in the ascent of Man,

but we venture to regard Huxley's version of the probabilities as one-sided. "In the case of mankind," he wrote, "the self-assertion, the unscrupulous seizing upon all that can be grasped, the tenacious holding of all that can be kept, which constitute the essence of the struggle for existence, have answered. For his successful progress, as far as the savage state, man has been largely indebted to those qualities which he shares with the ape and the tiger; his exceptional physical organisation, his cunning, his sociability, his curiosity, and his imitativeness, his ruthless and ferocious destructiveness when his anger is roused by opposition." This requires to be corrected by the facts Kropotkin has gathered to show the importance of mutual aid, and by what we know of the indispensableness of the prolonged maternal care and a measure of self-subordination. A clear note was struck by the late Professor Weismann: "It is a perversion of the theory of evolution to maintain, as many have done, that what is merely animal and brutal must gain the ascendancy. The contrary seems to me to be the case, for in man it is the spirit, and not the body, that is the deciding factor." This we regard as good science.

Not very much is known in regard to the factors in the Ascent of Man; but more is known than some agnostics or anti-evolutionists will admit. In illustration of this we venture to refer for a little to the arboreal apprenticeship of the Primates as studied by Dr. R. Anthony and Prof. F. Wood Jones. A new door was opened when the foot became the supporting and branch-gripping member, and the hand was set free to reach upward, to hang on by, to seize the fruit, to hug the young one close to the breast. The evolution of a free hand made it possible to dispense with protrusive lips and gripping teeth, and thus there began the correlated en-

largement of the brain-box and the bringing of the eyes to the front. Another arboreal acquisition was a greatly increased power of turning the head from side to side, and many other changes were involved in backbone and collar-bone, in chest and respiration, in hand and brain. "It is the freed hand which is permitted to become the sensitive hand, which now, so to speak, goes in advance of the animal and feels its way as it climbs through life." (See F. Wood Jones, *Arboreal Man,* 1916, and also "The Origin of Man" in *Zoology and Human Progress,* 1919.)

§ 6. *Human Evolution Contrasted with Animal Evolution.*

It is interesting to inquire how evolution-processes in the Kingdom of Man agree with and differ from those in the Realm of Organisms generally. The question is important especially in reference to the view that human history is not only continuous with, but is not more than a continuation of animal evolution. For there is a present-day school who maintain that sociology is only a department of zoology, and that again of dynamics.

There is no doubt that the great facts of variation, modification, and heredity, and the operation of natural selection and isolation are demonstrable in mankind. Albinism is a human mutation, sunburning a human modification, night-blindness a human Mendelian character, in certain diseases there is discriminate mortality or natural selection, and various clans illustrate the influence of isolation. Up to a certain point all is with man as with animal.

The differentia becomes plain when we observe that Man is aware of his own evolution and seeks to direct it according to his ideals. There is no analogue among animals to deliberate selection based on a eugenic ideal. Rational selection

transcends natural selection. We cannot accept the suggestion that selective processes in mankind are not exclusively automatic as they are in Nature, for it is an essential part of our argument that they are not wholly automatic in the lower sphere. It was not indeed by taking thought that the ancestors of leopards changed their spots so that their descendants had a garment of invisibility when crouching in the dappled light of the forest, but it may have been at least horse-sense that led their descendants to form a habit of choosing the places where the illumination suited them. We have already argued that whenever an animal takes an active share in its own evolution, the process ceases to be wholly automatic. What differentiates man is his attempt to control his evolution according to an ideal. A rational and sometimes an ethical note is sounded.

We may give another illustration of our meaning. Isolation and consequent inbreeding have probably meant a good deal in a purely biological way in fixing the dominant characters of tribes and stocks. But the facts of history warrant us in saying that it is a false simplicity to omit as a factor in the unification, at least as important as the bonds of kinship, the unanimism wrought out by a common hope or ambition. It is a fallacious biologism to think that human evolution can be accounted for without a recognition of Man as a rational and social personality.

The first reason why we cannot regard the history of human societary forms as simply a continuation of infrahuman organic evolution is that in society we have to deal with integrates which work as wholes apart from the function of the component individuals. An approximation to this on the instinctive plane of evolution is to be found in the bee-hive, in ant-hills, and in termitaries. A far-off hint

of it on the intelligent plane is to be found in the beaver village and the band of monkeys.

Professor McIver has argued very clearly that in mankind there are no individuals who are not social individuals, and that a society is not other or more than the members who compose it. The social relationships of every individual are not outside him, they are aspects of his individuality. There is no social function which is other than the functions of personalities.

We agree that there is no mysterious entity which we call a society, or a social integrate, or a societary form; that each is composed of a number of more or less like-minded and like-bodied individuals. But we are inclined to think that Mr. MacIver's recoil from a false antithesis between society and the individual, leads to an under-appreciation of the difference that social life makes. When men are associated and organised and integrated, their corporate behaviour does not follow as a matter of course from what we know of them as individuals. There is a strange psychology of the crowd. The same holds true of animals, to whom it is always a relief to turn. Termites sometimes go on food-collecting forays, 300,000 in a vigorous band, about 200 soldiers to 1,000 workers. At critical places the soldiers form a guard for the foragers; they give signals, they act as scouts, they keep or restore order. If they lose their presence of mind and fall back among the workers there may be a panic. Here, on an instinctive line, is social organisation, and our point is simply that, when integrates of individuals act as units of a higher order, a new complication is introduced. This complication is necessarily much greater in mankind where social tradition counts for much, and where the integrates, such as communities or nations, that now and again

rise to some glorious expression of unified life, are not comparable to species or to varieties of animals, but are united by bonds quite different from those of blood-relationship. Two nations at war are not closely comparable to two species of animals in internecine competition, if we admit that there are secure instances of this to be found. One difference is that a nation is not a kin-unit as a species is, and another difference is that the issue of the struggle depends in part on extra-individual factors, such as wealth, and there are other differences.

The second differentia concerns the nature of variations. In the Realm of Organisms variations count only in so far as they are continued in the germ-plasmic inheritance of descendants. In the Kingdom of Man this is true as regards organic qualities, but it is not true as regards the influence of the movers and shakers of the world, nor as regards another kind of societary variation, such as a sudden change from an Imperial dynasty to a republic, or any re-organisation of institutions after disasters or clashes. In human society extra-organismal variations bulk largely.

The third differentia is illustrated in the predominant rôle of the social heritage. For racial progress in physique and mental vigour what counts is the natural inheritance, the germ-plasm. For societary progress in good will, in discrimination, in adjustability, in appreciation of the beautiful and so on, what counts is also the natural inheritance, but of vast importance as well is the extra-organismal heritage, the social heritage of literature and art, the folk-ways of customs and tradition, the external registrations which we call institutions.

The fourth differentia is to be found in the ethical quality of certain forms of social selection, which sound a new note.

In ordinary affairs a feckless unreliable person who is very delightful in many ways, but cannot be trusted to keep appointments, gets left automatically. The traditions of business-likeness, the social systematisations, make him impossible, and he is elbowed out as a failure. This is closely comparable to the process in Nature by which a variant that is incompatible with the external systematisations gets sifted out. But there is in society another and distinctive kind of sifting which works potently for good and ill, where a social ideal of some sort is defined, and organisations are formed, both on the temporal and spiritual side, to realise it. There is deliberate controlled selection and its instruments are integrates, not individuals.

It seems, then, that in societary variations, apart from those due to the great men; and in social extra-organismal heritage, apart from all germ-plasm; and in societary selection, apart from natural selection in society, new notes are sounded, which forbid any false simplification of the facts, which in sociology is called a biologism and in biology a materialism.

Hear, then, the conclusion of the whole matter. There are some who think human society is just a new edition of the animal community or of the alleged animal gladiatorial show, and *they* are wrong. There are others who think human society is on a plane wholly apart, a little lower than that of the angels, where all talk of germ-plasm and other abominations of the breeding-pen is irrelevant, and *they* are wrong.

The truth is between the two extremes, and the whole truth has not yet been revealed. We have given attention to the contrast between organic evolution and social history because inattention to such contrasts is the theo-

retical complement of fumbling and muddling in practical affairs.

For practical purposes the most important feature of the contrast we have been working at lies in the rôle that the extra-organismal plays in the history of human society, and here we venture to quote a striking passage from a well-known evolutionist, Dr. Chalmers Mitchell, the secretary of the Zoological Society of London.

We are familiar with Kant's beautiful passage beginning: "Two things fill my mind with ever renewed wonder and awe the more often and deeper I dwell on them—the starry vault above me, and the moral law within me."

"We may well agree," says Chalmers Mitchell, "that the starry vault is a supreme example of the reality and externality of the physical universe. . . . I assert as a biological fact that the moral law is as real and as external to man as the starry vault. It has no secure seat in any single man or in any single nation. It is the work of the blood and tears of long generations of men. It is not in man, inborn or innate, but is enshrined in his traditions, in his customs, in his literature and his religion. Its creation and sustenance are the crowning glory of man, and his consciousness of it puts him in a high place above the animal world. Men live and die; nations rise and fall, but the struggle of individual lives and of individual nations must be measured not by their immediate needs, but as they tend to the debasement or perfection of man's great achievement" (1915, p. 107).

§ 7. *In What Sense May It Be Said that Nature Is Crowned in Man?*

It may be said that Man is the outcome of a persistent trend—towards freedom of mind—which has been characteristic of the process of organic evolution for millions of years. A Martian zoologist, on another line of life altogether, would, we fancy, have said in his report on a scientific expedition to our planet in Eocene times, that the Sauropsidan line of evolution had been crowned in the peopling of earth and sky with a fascinating set of bipeds, of quaintly engaging ways and consummate locomotion, with adorable parental virtues and an extraordinarily high level of artistic culture which seemed to be quite instinctive to every one of them, and so pervasive that many of them could not perform the commonest offices of life, without investing them with grace. He was reporting on Birds, of course.

But is it not justifiable, in an equally detached way, to say of Man that he crowns one line of Mammalian evolution? He shows in notable excellence what his predecessors, both direct and collateral, have moved slowly towards,—a large and intricate cerebral cortex, a subtle integration of the body, and a masterly resourceful behaviour.

We cannot suppose, with the scholars in the school of Naturalism', that the only realities are those that Natural Science deals with, but we are not sure that Mr. Arthur J. Balfour is accurate when he speaks of Man being, according to Naturalism, "no more than a phenomenon among phenomena, a natural object among other natural objects, his very existence an accident, his story a brief and transitory episode in one of the meanest of the planets". For even from the position of 'naturalism', it does not seem justifiable

to call Man's "very existence an accident". There may be accidents in evolution, though we think there are few, but they do not last for two millions of years. An ascent that has probably occupied between two and three millions of years is not well described as "a brief and transitory episode". Man may have been the greatest of mutations, but there is no scientific warrant for regarding him as a freak. He is congruent with antecedent and collateral evolution towards higher nervous organisation.

In the same way we cannot admit that Huxley was talking good science when he insisted that Man's only chance of ethical progress was to combat the cosmic process. He made this antithesis because he saw in Nature a vast gladiatorial show, a ubiquitous Ishmaelitism, every living creature for itself and extinction taking the hindmost. He made man a stranger in Nature by failing to appreciate adequately the fact that throughout the struggle for existence in Nature there is often a pathway to survival and success through increased co-operation, kindness, and mutual aid, as well as through increased competition and self-assertion. Along the line of combination and mutual aid Man has made some of his greatest advances, and this line was indicated, as it were, by Nature to him.

We have already asked whether there is not an ethical finger-post in Nature's strategy that the individual living creature realises itself in its inter-relations, and has to submit to being lost that the welfare of the whole may be served. There is much indeed to be said for the thesis (which Prof. Patrick Geddes has maintained) that the ideals of ethical progress—through love and sociality, co-operation and sacrifice, may be interpreted as the highest expressions of the central evolutionary process of the natural world.

Taking a broader than scientific view, we recognise that there are other ways in which it may be said that Nature is crowned in Man. He is Nature's interpreter, rationalising the whole. In him the inherent rationality of Nature, the Logos, became articulate, and found, moreover, joyous appreciation.

We cling to the Aristotelian doctrine of the End as the philosophical explanation of what goes before. As Prof. A. S. Pringle-Pattison puts it in his Gifford Lectures, "The nature of a power at work in any process is only revealed in the process as a whole. It is revealed progressively in the different stages, but it cannot be fully and truly known until the final stage is reached. . . . Now man is, from this point of view, the last term in the series, and the world is not complete without him." We are grateful for what seems to us wise teaching, but we venture to suggest that in regard to a race and an external heritage that may go on evolving for millions of years to come it is premature to speak of 'final stage' or 'last term'.

SUMMARY.

There are in the Realm of Organisms many masterpieces, reaching along diverse lines to approximately equal heights of differentiation and integration. Thus many insects in their way attain to extraordinary perfection. Yet no one hesitates in ranking birds and mammals as much 'higher'. This means that they excel in being very highly differentiated and integrated, but also that they exhibit the fullest expression of what the trend of evolution seems to make for, namely, freedom, mastery, and joyous consciousness. We call them "higher" for two objective reasons, but we colour these with an appreciation of values.

With inconceivable slowness the evolving stock of Primates was differentiated along distinct lines. New World monkeys, Old World monkeys, small anthropoids, and large anthropoids were in turn

segregated off. The evolving human stem was further pruned by the divergence of doomed races,—Pithecanthropus, Neanderthalers, and perhaps the men of the Sussex Weald. It is perhaps a million years since the human standard of brain was reached.

In Man's bodily structure there is an all-pervading similitude with the higher Anthropoids; his blood mingles harmoniously with theirs; he is a museum of relics in the form of vestigial structures and he is shot through with atavistic proclivities; in his development he climbs up his own genealogical tree. Man is solidary with the rest of creation.

On the other hand, Man is quite unique in his capacity for forming and experimenting with general ideas or concepts (reason), in his power of reasoned discourse (language), in his vivid consciousness of himself as a personality with a history behind him and with strong kin-instincts binding him for his own self-realisation to his fellows. Man is apart from the rest of creation.

Of the factors in the establishment of human species we are very ignorant. A great increase in brain capacity, implying marked educability, perhaps arose as a mutation, as genius does still. Perhaps a temporal variation, implying a prolongation of antenatal life, infancy, and childhood, was of importance. Also to be considered are the results of arboreal life, of the emancipation of the fore-limb, of walking erect, of using sticks and stones, of building shelters, of living in families, of talking a good deal—and all these began in Primates lower than Man. Furthermore, there were a good many experiments in social organisation prior to Man.

Human history, though continuous with, is more than a continuation of animal evolution. Man is a rational and social personality, understanding something of his own evolution and seeking to have a hand in it, directing it in reference to an ideal. When the factors in social history are compared with those of organic evolution, great differences appear. In society we have to deal with integrates which work as units, in a manner which cannot be adequately described in terms of the functions of the component individuals. In social evolution enormous importance attaches to the extra-organismal,—to societary variation, to the social heritage, and to deliberate social selection by social methods.

In what sense may we say that Nature is crowned in Man? He is the outcome of a persistent trend towards dominance of mentality, and he carries this to finer issues. Man cannot be regarded as 'accidental' or 'episodic'; he is the outcome of a long-con-

tinued orthogenesis. Man is Nature's interpreter, rationalising the whole. In him the Logos became articulate, and found, moreover, joyous appreciation. To Man also it has been given in an extraordinary degree to control Nature's operations for his own purposes. He has often put more meaning into Nature by mastering it.

LECTURE XVIII.

DISHARMONIES AND OTHER SHADOWS.

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§ 1. *Difficulties in the Way of a Religious Interpretation of Animate Nature.* § 2. *Extinction of Highly Specialised Types.* § 3. *Imperfect Adaptations.* § 4. *Disease.* § 5. *Parasitism.* § 6. *Cruelty of Nature.* § 7. *Senescence and Death.* § 8. *Apparent Wastefulness.* § 9. *A Balanced View.*

§ 1. *Difficulties in the Way of a Religious Interpretation of Animate Nature.*

SCIENCE has strictly to do with the operations which go on in Nature. It may legitimately inquire, indeed, into the purposes that prompt the efforts of the higher animals, or into the means by which certain results have been achieved, but it has not to do with the problem of the meaning of Evolution. Metaphorically we have occasionally spoken of the tactics of Nature, notably the great trial and error method of Natural Selection, but we confess that this is leaving strictly scientific terminology. And if the metaphor of 'tactics' be allowed to pass, we must not offend by speaking of strategy. Yet as rational beings we insist on pushing beyond science to a more all-round or synoptic view which inquires into the significance of things and of organic evolution in particular. That organic evolution has led on to Man is certain—the only known organism to understand it a little; the general trend of organic evolution is integrative and towards what at our best we value most—goodness, beauty, and the health that leads to truth; there is, we maintain, a scientifically demonstrable progressiveness: these and

other considerations give us what we may call a scientifically justified expectancy of discovering significance. But it is through other paths of experience that men come to believe —if they have the will to believe—in there being a strategy behind evolution, which is partly what believing in God means. Given, in other than scientific experiences, some conviction of an increasing purpose, ultimately spiritual in content, the question rises whether the state of affairs in Animate Nature and the way in which this has come about is congruent with a religious interpretation.

We repeat that a scientific survey of the system of which we form a part cannot prove anything as to the significance of the whole; that is certainly not its *métier;* yet it is legitimate to ask whether the impressions afforded by the scientific survey are consistent with regarding Nature as the expression of a Divine Thought or Purpose. But it is often said that this consistency can be recognised only by those who are willing to ignore the seamy side of things. Let us therefore face some of the disharmonies and shadows.

§ 2. *Extinction of Highly Specialised Types.*

One of the shadows which cannot be ignored is the lack of plasticity in highly specialised types. The physical world is changeful, in climate, in weather, in surface-relief, and there are many living creatures which are unable to change with it. They have gone too far to tack, and they perish. Adaptations to novel conditions abound, but the over-specialised are sometimes victims of their own perfection. Many types of great excellence have thus passed away without leaving any direct descendants. The graceful Graptolites, the robust Trilobites, the highly specialised Eurypterids, the great Labyrinthodonts, Ichthyosaurs, Plesiosaurs, and the

Pterodactyls that could fly, are such lost races, not continued into other stocks, wonderful achievements, but lacking in plasticity. As the palæontologist Marsh said, the epitaph of the Iguanodon might be, "I and my race died of over-specialisation", and he might have added 'and stupidity', for there was not in these ancient giants the intellectual resourcefulness which we see in the still more specialised modern birds who can adapt themselves to many a drastic change.

We must admit that the extinction of splendidly perfect types raises strange thoughts. What can one say save that every art is limited by its medium, and that here the medium is twofold, the inorganic and the organic? The inorganic world is the grindstone on which life has been whetted, and it cannot become a soft cushion. An environment without vicissitudes might have meant an unprogressive fauna and flora of jellyfishes and seaweeds. Against the callousness of the inorganic domain, moreover, we should remember, though with dread of a circular argument, the other fact that the physical conditions are singularly well suited to be a home of living creatures. Moreover, the lack of plasticity in organic structure is the minus side of that stability which marks the journey-work of millennia. What is stable cannot also be labile. Furthermore, some of the gains of lost races may be continued on collateral lines.

§ 3. *Imperfect Adaptations.*

Another shadow is the existence of imperfect adaptations. These are of two kinds. First, there are established arrangements which work well on the whole, but now and again break down or miss the mark, as is the case with tropisms and instincts that are in ninety-nine situations adaptive, but in the hundredth suicidal. The crepuscular moth, unaccus-

tomed to light, flies into the candle, and the lemmings on the march seeking new territory swim out into the North Sea and are drowned in thousands. But the most keen-scented discoverer of disharmonies or 'dys-teleologies' will surely not suggest that organisms should be adapted for unusual exigencies rather than for the routine of daily recurrence. Even when there are adaptations to peculiar exigencies, as we see in the surrender of damaged parts and their regrowth, these exigencies are of frequent recurrence.

There are instances, however, of structures that do not seem to work so well as we have got into the way of expecting from organisms. Thus attention has often been directed to the cumbersome twenty feet of intestine with which man is burdened without corresponding compensation. It may be doubted, however, whether much of a case can be made of any of man's disharmonies, since he is evidently in process of rapid change of habits. An organism originally adapted to feed when he could rather than when he would, must not complain too loudly if he is not perfectly adapted for absolutely punctual and well-proportioned meals.

In the case of some trees which spread their roots horizontally at a slight depth it not infrequently happens during a storm that the pressure of the wind on the branches causes a strain too great for the roots to stand. The tree falls, though in perfect health. This violent death reveals an undoubted imperfection, but it also shows how physical conditions eliminate such subtle defects as lack of proportion between spread of sail and strength of mast.

§ 4. *Disease.*

Those who would arraign Nature on the charge of tolerating disease may be almost dismissed from court. For, apart

from parasites and senescence, there is almost no disease in wild Nature. Should a pathological variation arise, and that seems a rarity, it is eliminated before it takes grip. Disease in the system of Nature is a contradiction in terms. Constitutional disease is the occurrence of a metabolism out of place, out of time, and out of tune, and Nature makes short work of such idiosyncrasies.

What, then, of potato disease and salmon disease, of fowl cholera and swine fever, of big-bud on our currant-bushes and bee-disease in our hives? The list may be lengthened out, but the answer is the same for all, that these diseases occur in artificial, humanly contrived conditions, not in the system of wild Nature with which we are here concerned. It is doubtful whether there are more than two or three examples of microbic disease in natural conditions, one of the best known being a bacterial disease in sandhoppers, and this may have something to do with sewage, as salmon-disease with polluted rivers.

It is not asserted, however, that wild animals may not be infected with microbes so that an epidemic results. What is maintained is that such occurrences are exceedingly rare and transient, and that they are usually traceable to rapid human interference,—to introducing new tenants into a region, to killing off the natural eliminators of the sickly, to permitting over-crowding, to an infection of the soil and water, and so forth.

What of a familiar case such as grouse-disease? The facts appear to be that grouse harbour a good many parasites which normally do them no appreciable harm. When birds of inherently weakly constitution appear they are normally eliminated by golden eagles, stoats, and other natural enemies; and the standard of the stock is not lowered. If over-

preserving, *i.e.,* careless elimination of the natural enemies, removes the natural sieves, then birds of weakly constitution tend to become more numerous with each year, till a bathos of weakness is reached. The contingent of parasites which seems to be kept within limits in the vigorous bird may then increase sevenfold, spreading, for instance, to new organs, and this may give the death-blow. It seems that there is no specific disease in this well-nigh sacred bird, and it is highly probable that there would be no 'grouse-disease' if there were no game-keepers.

§ 5. *Parasitism.*

One of the shadows on the pleasant picture of animate nature is the frequency of parasitism. To some minds it appears as a blot spoiling the whole script. But without denying that there is some warrant for practical, æsthetic, and ethical recoil, we think that much of this is due to lack of perspective. Let us briefly consider the facts of the case.

(*a*) Thousands of living creatures live in or on others, bound up with them in brutally direct nutritive dependence, and incapable of living in any other way. Uninvited and non-paying boarders they are, who make their hosts no return for the hospitality enjoyed. Most animals that have bodies at all have parasites in or on them, and the same is true of most of the higher plants which are the hosts of moulds and rusts, gall-producing creatures, and burrowing larvæ. One of the European oaks harbours no fewer than ninety and nine different kinds of gall-flies, and the hundredth is probably being discovered. The lac insect of India is attacked by thirty-one species of plant and animal parasites. The dog is a terrain for over forty parasites; man and pig have far more. In fact when we inquire into the

number of diverse parasites that may possess a lusty host, with a wide range of appetite, we find that they are legion like the demons. When we ask about the number of individual parasites, it is beyond telling.

(*b*) In many cases the association of parasites and host is very specific, that is to say, many a parasite is only known to occur in one definite kind of host, and many a host is curiously non-susceptible to parasites not very different from those which it harbours. The larvæ of some of the freshwater mussels cannot become parasitic except on definite species of fishes, though the larvæ of some other kinds can utilise many fishes. The larva of the liver-fluke in Britain cannot develop except in one species of water-snail (*Limnæa truncatula*), though in other countries other species sometimes serve. There are, however, some very cosmopolitan parasites which occur in many hosts.

(*c*) Parasitism is a relation of dependence—always nutritive, often more—between the parasite and the host, but it occurs in many grades. There are superficial ectoparasites which often retain great activity, and intimate endoparasites which may become practically part of their host. There are partial parasites which retain independence during some chapter or chapters of their life, and total parasites which pass from host to host and are never free. Sometimes, it is only the female that is parasitic, the male remaining free.

(*d*) Corresponding to the degree of parasitism is the degeneration of the parasite. This is sometimes to be witnessed in the individual lifetime, *e.g.,* in many Copepod Crustaceans where the young are free-living. In other cases it may be inferred by comparing the parasite with related free-living types. The retrogression affects especially the nervous, sensory, muscular, and alimentary systems. The reproduc-

tive system is often highly developed and the multiplication very prolific, which may be associated (*a*) with the fact that the parasite is often living without much exertion, with abundance of stimulating food at its disposal, and also (*b*) with the probability that as the chances of death are often enormous, non-prolific forms have been persistently eliminated. Parasites survive not because they are strong, but because they are many.

(*e*) While there are many different types of parasites, it is of interest to notice that some kinds of organisation are not compatible with a parasitic mode of life. Among backboned animals the only parasite is the hag (Myxine) and it is not thoroughgoing. There are very few parasitic Molluscs or Cœlentera, and there are no parasitic Echinoderms, partly perhaps because the life of these three types is very dependent on the activity of ciliated cells which usually require fresh water-currents. Among plants, most of the parasites are Fungi and very few are Flowering Plants.

(*f*) The life-histories of parasites are often very intricate and full of risks. In many cases two hosts are required. The embryos of the liver-fluke pass from sheep to water-pool; the hatched larvæ enter a water-snail; there are several asexual generations in this first host; minute flukes leave the snail and encyst on blades of grass; if these are eaten by a sheep —the second host—the cycle recommences. There are curious cases of hyper-parasitism where one parasite contains a second which contains a third, and this gives rise to complicated life-histories.

(*g*) Thoroughgoing parasites, with a long evolution behind them, are naturally enough well-adapted to the conditions of their life. Thus a tapeworm in the intestine of its host absorbs food by the whole surface of its body; it has mus-

cular adhesive suckers and sometimes attaching hooks; it can thrive with a minimum of oxygen; it has a mysterious 'anti-body' which prevents it being digested by its host; it is exceedingly prolific; and it is self-fertilising. The tapeworm may be ugly, but it is very well-adapted; it may be repulsive, but in the technical biological sense, relative to the given conditions, it is 'fit'.

Such are a few of the most important facts in regard to parasitism. Let us now inquire why the prevalent inter-relationship seems to many a dark shadow. Parasitism is repulsive for three reasons: (1) because we dislike to see fine organisation devastated, (2) because many parasites produce an unpleasant æsthetic impression, and (3) because the life of ease and sluggish dependence grates on our ethical sense or on our idea of an organism.

(1) Many people resent the fact that a contemptible microbe may kill a genius before he comes of age, and that paltry flies put a drag on the wheel of the chariot of civilisation. It is abhorrent that fine organisation should be spoiled by intrusive parasites, but it is necessary to look all round the facts. (*a*) In a multitude of cases the parasites do not greatly trouble their hosts, a *modus vivendi* has been established. If the host be of a weakly constitution or enfeebled by lack of food, the parasites hitherto trivial may get the upper hand and bring about the death of the host. But this sifting will make for racial health, and cannot be called abhorrent. (*b*) Mortality from parasites is in most cases a consequence of organisms entering a new area and becoming liable to attack by creatures to which they can offer no natural resistance, or a consequence of the introduction of the parasite into a new area where it finds new hosts abnormally susceptible to it. Cattle introduced into a

tsetse-fly belt are fatally infected by a trypanosome which does not seem to damage the native antelopes in which it is, so to speak, at home. The fatality of a new microbe introduced into a new population is familiar, as in the case of the Black Death in England, which was due to the introduction of the microbe of bubonic plague.

It must be remembered that the effect of the parasite on the host is extraordinarily varied. Some give off toxic substances; others cause lesions and inflammation, especially if they stray from their usual habitat in the body; some promote beautiful growths like oak-apples and pearls; others drain the food-supply; some do very little harm. The sturdie-worm causes locomotor disorders in the sheep in whose brain it grows, but the Gregarines found in the reproductive organs of most earthworms seem usually unimportant in their effects. The parasitic crustacean known as Sacculina destroys the reproductive organs of crabs and changes the male constitution towards the female type, so that a small ovary may develop. The shape of the crab's abdomen changes, approximating to that of the female, and the protruding parasite is actually guarded by its bearer as if it were a bunch of eggs. But many 'fish-lice' seem to do very little, if any, harm to their bearers. It is highly probable that very aggressive parasites have eliminated themselves from time to time by killing their hosts, which it is not to a parasite's interest to do.

(*c*) It seems useful to place by themselves parasites like virulent Bacteria (*e.g.*, the Plague Bacillus) and virulent Protozoa (*e.g.*, the Trypanosome of Sleeping Sickness) which are rapidly fatal when transferred to a new kind of host. Thus the Plague Bacillus is transferred by the rat-flea from the rat, who can stand it, to man who has no constitutional

defence against it. Similarly, the tsetse-fly transfers the trypanosome from some immune wild animal (such as an antelope, it may be) to the highly susceptible man. But these microbes are not in any special way adapted to parasitic life; they might as well be called *predatory*. Many predatory parasites, like Trypanosomes, live an exceedingly active life within their host, exerting themselves as much as many a free-living creature.

(2) Many parasites are æsthetically repulsive in form, colour, and movements, and it is interesting to contrast the attractive free stages of some of them with the ungraceful bloated parasitic stages. As we have already seen, the ugliness is the brand of their degeneracy. It is the natural result of retrogression, sluggishness, and over-feeding. The life of ease drifts and it loses the grace of the sharpened life which commands its course. The dodder and mistletoe, which every one must admit to be beautiful, are, it is interesting to notice, only partial parasites. The ugliness of some parasites is perhaps an exception that proves the rule; it is as if Nature said: This asylum is open, if you will, but if you enter, you must wear the livery of dishonour; beauty will disappear.

(3) To many minds, however, the darkness of the shadow is in the inconsistency between the parasitic mode of life and Nature's usual insistence on a strenuous life, and this has to be admitted. But one must remember how parasitism arises in the struggle for existence. Environing limitations and difficulties press upon the organism and one of the solutions which is open to many is to evade the struggle by becoming parasitic. The struggling, endeavouring creature cannot have a clear prevision of the *facilis descensus* it has set foot on. It may try to survive inside a larger organism

which has swallowed it; in its searchings for food and shelter it may discover what is to it simply a new world—on or beneath the surface of another organism. It is not another organism to them as it clearly appears to us; it cannot be separated off from other areas of safety and abundance which other struggling organisms may secure.

It is exceedingly difficult to draw a dividing line between some parasites which are of some slight use to their hosts, *e.g.*, the beautiful Infusorians in the stomach of some herbivores like horse and cow, which seem to help in breaking down the food, and certain symbions or commensals which are on the whole useful, but levy a slight tax. Some ecto-parasites behave as if it was their duty in life to keep the surface of their host's body clean. All the three modes of life are to be looked at as expressions of the widespread tendency in Animate Nature to establish inter-relations between organisms, to link lives together, to weave a web of life. It may be occasionally repulsive, but it is to be considered broadly as a part of a complex external systematisation or correlation that has been evolved in the course of ages and is of great importance in the process of Natural Selection.

It must not be forgotten that parasites occasionally play a part as eliminative agents, and may work towards conservation as well as wastefully. They may weed out the weakly members of a stock. They may put a useful check on abrupt changes of distribution. Another exonerating fact is that in a number of cases, *e.g.*, among Crustaceans, the parasitism is connected with the continuance of the race, and is altruistic as much as egoistic, for it is confined to the mother-animals, who seek a safe place in which to bring forth young.

(4) It must be admitted that there is an occasional hint

of 'wildness' about parasitism, just as about some other ways of life. No explanation can be offered except that organisms have in them something akin to the artist's genius. They have endless resources and they are free. Some have explained that it is not the destructiveness of parasites they object to, nor their ugliness, nor even their feckless drifting life, but their devilishness. The ichneumon-fly lays her eggs in a caterpillar; the hatched grubs feed on the living tissues; they make their way out to begin a new phase of life after they have killed their host. It is very difficult, however, to avoid anthropomorphism in such cases. Perhaps it does not matter much to the caterpillar whether it is devoured from the inside or from the outside, and perhaps the ichneumon larvæ should rather be called beasts of prey than parasites. In any case it is certain that what the ichneumon-insect does to the caterpillar is not so repulsive as what man often does to man, for man knows or should know what he is doing. In both cases there is devilry, but the ichneumon's is unconscious. Moreover, it plays a very important rôle in the extraordinarily well equilibrated economy of Nature.

§ 6. *Cruelty of Nature.*

The system of Animate Nature is evolved on the scheme that many kinds of living creatures use others as food. If this be cruelty, then Man is in it too. But in most cases there is no reason to drag in the idea of cruelty; taken in the strict sense the word does not and cannot grip.

It should be remembered, if it makes any difference, that many animals are vegetarian and that many depend upon organic débris. Thus great hordes of marine animals live on the detritus washed outwards and downwards from the littoral vegetation of Algæ and sea-grass. That all living

creatures should have pursued the plant régime of living on air, water, and salts is conceivable, but it would not have been an adventurous resolute world, for the vigorous higher life depends on a supply of high explosives manufactured by other creatures. If animals had had to manufacture their own munitions as plants do, there would not have been much fighting, but there would not have been much thinking either.

But the critic of Nature explains that it is not the carnivorousness that offends him,—he does a little in that way himself—it is the manner of its accomplishment. The gentle disciple of Izaak Walton is pained that the Fishing-Frog should use a rod and line. The housewife who sets a trap for mice in the pantry affects to shudder at the ant-lion which makes a pitfall for unwary insects. There is a taint of insincerity about all this exotic tender-heartedness. The joy of the cat is the grief of the mouse, says a Russian proverb; but we go a-fishing with a light heart. We are of more value than many trout. We do not deny that there are some difficult cases, like that of the cat playing with the mouse, which has perhaps an educational significance—and what may not be done in the name of education—but in the great majority of cases violent death is rapid and probably painless, and the accusation of cruelty is an irrelevant anthropomorphism. We do not deny that there are what look like dark shadows in Animate Nature, but we have seen some of them disappear in the light of fuller knowledge, and we think that William James was on the whole misled by unawareness of the facts, when he wrote of Nature—to some of us an alma mater—as "a harlot", "all plasticity and indifference", "a moral multiverse and not a moral universe". "Beauty and hideousness, love and cruelty, life and death keep house together in indissoluble partner-

ship; and there gradually steals over us, instead of the old warm notion of a man-loving Deity, that of an awful power that neither hates nor loves, but rolls all things together meaninglessly to a common doom." But this seems to us a terribly alarmist inference to base on a demonstrably inaccurate study of Animate Nature. It is not really the case that beauty and hideousness, love and cruelty, keep house together in indissoluble partnership.

We must confess, however, that even the naturalists are often against us. Thus the veteran John Burroughs writes in his charming *Breath of Life:* "What savagery, what thwartings and delays, what carnage and suffering, what an absence of all that we mean by intelligent planning and oversight, of love, fatherhood! Just a clash of forces, the battle to the strong and the race to the fleet." Are we not all like perplexed privates writing bitterly of a campaign, knowing little of the actual operations, still less of the tactics, and nothing of the strategy? There are no doubt terrible minutes when two lions get the better of an antelope, or the wolves close in upon the deer, and huntsmen like Selous have spoken of the "frenzy of fear and agony of a dying brute". But we must beware of anthropomorphic exaggeration. We recall Mr. Louis Golding's good-humoured rebuke (1919):

> "But if a moth should singe his wings,
> The world is black with dismal things.
> And if a strangled sparrow fall,
> There is not any God at all."

Alfred Russel Wallace had wide experience of wild nature, and wrote: "Animals are spared from the pain of anticipating death; violent deaths, if not too prolonged, are painless and easy; neither do those which die of cold or

hunger suffer much; the popular idea of the struggle for existence entailing misery and pain on the animal world is the reverse of the truth." Similarly Darwin concludes his chapter on the "Struggle for Existence" with the sentence: "When we reflect on the struggle, we may console ourselves with the full belief that the war of nature is not incessant, that no fear is felt, that death is generally prompt, and the vigorous, the healthy, and the happy survive and multiply."

We must beware of anthropomorphic exaggeration, but we must also beware of commonplace inaccuracy. The death-crisis of a mouse killed by a rattlesnake was 13 seconds; the death-crisis of a thrush killed by a golden eagle was less than half that.

We frankly admit, however, that for some reason or other many of the forms of life are weird and fantastic creations, and there is often more than a hint of the "wildness" of which Prof. William James spoke. The solitary wasp Philanthus, known as the bee-eater, catches bees and after giving the victim a knock-out blow beneath the chin and paralysing it, proceeds to knead its anterior body, squeezing out the honey from the crop and enjoying the grim meal. But if instead of turning away repelled we follow the Philanthus, we find that the body of the bee is used as provender for the larvæ whose hatching the Philanthus does not survive to see. We may rest satisfied with this without following the famous entomologist who has told us that the kneading operation which squeezes the honey out is not so much for the parent's immediate gratification as to prevent the larva from having stomach-ache.

§ 7. *Senescence and Death.*

Another shadow is senescence and death. It saddens us to see a fine edifice falling into ruins, and though old age is often beautiful in mankind, the time comes when even beauty goes. Let us recall the picture which we owe to the author of Ecclesiastes: The mind and senses begin to be darkened, the winter of life approaches with its clouds and storms, the arms—the protectors of the bodily house—tremble, the strong legs bow, the grinders cease because they are few, the apples of the eyes are darkened, the jaws munch with only a dull sound, the old man is nervously weak and startled even by a bird's chirping, he is afraid of even hillocks, his falling hair is white as the strewn almond blossoms, he drags himself along with difficulty, he has no more appetite, he seeks only his home of rest, which he finds when the silver cord is loosed or the golden bowl broken.

There is something indescribably pathetic in the decline and the decay when it passes beyond senescence into senility. The bones become lighter and less resistant, the muscles weaker and stiffer, the nervous system slower and less forceful, the heart less vigorous, the arteries less elastic, the parts fail to answer to one another's call, "and then, from hour to hour, we rot and rot".

In regard to this dark shadow, it must first be pointed out that the securing of a healthy old age is very largely within man's control, everything depending on the nature of our physiological bad debts. Many are successful in securing an old age such as Cicero praised; others have one whose days are labour and sorrow. In recent times, the late Professor Metchnikoff has been prominent in maintaining that if man led a more careful life, and had a more

enlightened understanding of the limitations and disharmonies of his constitution, he would no longer, as Buffon said, die of disappointment, but would attain everywhere a hundred years.

The second point is not less important. As Professor Humphrey, a specialist on old age, has said, "Strange and paradoxical as it may seem, this gradual natural decay and death, with the physiological processes which bring them about, do not appear to present themselves in the ordinary economy of nature, but to be dependent upon the sheltering influences of civilisation for the opportunity to manifest themselves, and to continue their work." The fact is that man and some of his domestic animals have almost a monopoly of senility, while wild animals rarely show a trace of it. Thus senility is not disharmony in Nature, but in the Kingdom of Man.

The bathos often seen in man is due partly to the way in which he shelters himself from violent or extrinsic death, which cuts off so many—if not most—animals; partly to the unnatural ways in which he lives; and partly to his deficiency in the resting instinct.

It is instructive to probe the matter further, inquiring into the reasons not for senility, but for senescence and natural death. There is an obvious distinction between (*a*) death due to microbes or parasites, (*b*) death due to extrinsic agencies or violence, and (*c*) death due to internal constitutional reasons; it is with the last, natural death and its antecedent senescence, that we have to do. To the question: Why should an organism grow old?, many answers have been given. A reason has been found in the wear and tear of parts, especially of elements like nerve-cells, which do not in higher animals increase in number, nor admit of renewal,

after early stages in development. We do not get any additions to our nerve-cells after birth. But why might not nerve-cells have retained the power of regeneration that they have in some of the lower animals?

A reason for old age and natural death has been found in the slow accumulation of poisonous waste-products, of the results of incomplete combustion, of the results of bacterial activity, and so on. The fire of life may be smothered in its own ashes. But it must be recognised that there is no necessity for this, that we can conceive of more perfect arrangements for purification. Isolated pieces of tissue can be kept for a long time living if waste-products are carefully eliminated. Similarly it has been pointed out that ageing is associated with the diminishing activity of glands of internal secretion, with a cumulative disproportion between cytoplasm (cell-substance) and nucleoplasm, with the occurrence of organically expensive modes of reproduction, and so on. But these suggestions seem to disclose what are merely symptoms of some more fundamental imperfection.

What that is may be discovered by asking whether it is really the case that all living creatures grow old and die. We know that an insect may live for days, another for weeks, another for months; that a fish may live for years, man for scores of years, and a Big Tree for centuries; but are there any creatures that need not die? It seems that natural death is more or less successfully evaded by most of the Protozoa, which, being unicellular or non-cellular, have no 'body' to keep up, which have very inexpensive modes of multiplication, which can continually recuperate their wear and tear. There is good reason to suspect that the same is true of multicellular animals like Hydra and Planarian worms.

The clearest statement of the problem has been given by Prof. C. M. Child in his *Senescence and Rejuvenescence.* The process of progressive differentiation or complexifying involves the accumulation of relatively inactive constituents in the living matter. It becomes necessary to have stable frameworks, and it is difficult to keep these young. The vital current deposits materials in its flow, and the bed begins to slow the stream. There are always processes of rejuvenescence at work, removing the relatively inactive material, and re-accelerating the rate so that fresh erosion occurs. All sorts of devices are resorted to, which secure rejuvenescence; many of them are very drastic, such as periodically breaking the body to bits and beginning afresh; but the tendency is for rejuvenescence to lag in the higher animals and for senescence to win. It cannot be otherwise. Death was the price paid for a body; senescence is the tax on specialisation. In the very simple organisms the stable mortal parts of the colloidal substratum, which is life's laboratory, can be reduced and restored piecemeal, and the creature never grows old. Perhaps the same is true of the fresh-water polyp, which thus will have, besides its indifference to wounds, another reason for being called Hydra. But as life became more worth living, and the organism more of an agent, the capacity for rejuvenescence was limited. Thus, as Professor Child tells us, "For his high degree of individuation man pays the penalty of individual death, and the conditions and processes in the human organism which lead to death in the end are the conditions and processes which make man what he is." Thus one may perhaps say without irreverence that science has made the shadow of death more intelligible.

What have we, then? At the foot of the scale there are

some organisms in which rejuvenescence keeps pace with senescence, and natural death is evaded. At the top of the scale there is the senility of many men and of some domestic animals, like horses and dogs. It is certain that senility is not within the scheme of Animate Nature apart from Man. For many wild animals there is normal senescence, for many there is not even that. There is a slight lowering of vitality and a slight environmental buffet sends them off the stage. But why is it that the fish *Aphia pellucida* lives only for a year, dying off like an annual plant, while others live for many years? The probability is that the duration of life is limited to some extent by the constitution of the creature, but that within these limits it has been regulated in adaptation to the conditions of life, that it has been punctuated in reference to large issues, namely the welfare of the species. Not that there is any purposive adjustment, but simply that for each set of given conditions there is an effective age which becomes the age of the surviving types. It is not difficult to understand that a variation in the direction of longevity might be very unprofitable and would be certainly eliminated by the gradual disappearance, paradoxical as it may seem, of the long-lived type. For the longevity might mean that the organism continued multiplying when it was past its best and thus impaired the vigour of the stock. The longevity might mean that the organism continued multiplying after it had suffered so many dints from the years that it could no longer give the offspring a successful send-off in life. Such variations condemn themselves literally, and the length of life is by selection adaptively punctuated towards the welfare of the race. In some of the higher organisms prolonged multiplication is constitutionally prevented on the female side after a certain age is reached, and

that is also adaptive. This idea must be gently transferred to human life. Apart from multiplication altogether, apart also from senility, which is often avoided with masterly success, it seems in Man's case very doubtful that it is for the good of the race that longevity should become too pronounced a habit. There is profound wisdom in Goethe's saying that Death is Nature's expert device for securing abundance of life.

§ 8. *Apparent Wastefulness.*

Another shadow is the apparent wastefulness. "So careful of the type she seems, so careless of the single life." The abundance of life has its correlate in the abundance of death. "What a book," Darwin wrote, a "a devil's chaplain might write on the clumsy, wasteful, blundering, low and horribly cruel works of nature!" (*More Letters,* Vol. I., p. 94, 1856). But we doubt whether he would have written this a quarter of a century afterwards, when his insight into the economy of Nature had grown clearer. We need not doubt, for in 1881 he wrote: "If we consider the whole universe, the mind refuses to look at it as the outcome of chance —that is, without design or purpose" (*More Letters,* Vol. I., p. 395, 1881).

Wastefulness is rather a question-begging epithet. The abundance of small fry has made the life of higher creatures possible. We do not say that the purpose of water-fleas is to feed fishes, any more than we say that the purpose of certain fishes is to feed man. What we say is that the extraordinarily prolific multiplication of humble organisms affords a stable foundation on which a higher life has been built. The number of free-swimming larvæ in the waters is beyond our powers of picturing, and we think too little of the wonder

of this everyday multiplication which is so different from anything in the inorganic world. Only a fraction of these larvæ come to anything, but since they form the sustenance of finer expressions of life, we see no reason to speak of wastefulness. The scheme of Animate Nature is in part a cycle of incarnations; we may not approve of the scheme, but it is not a wasteful one. In this connection it may be observed that it is a misrepresentation to speak, as Professor Hobhouse does, of the result of evolution being that " Species should learn to destroy each other more efficiently ", for this disguises two facts,—(1) that huge numbers of animals live on detritus, which is often produced by physical agencies; and (2) that what very frequently happens is the establishment of a *modus vivendi* which lives and lets live. But our general point is this, that a certain security as regards the means of subsistence is a condition of economising reproductivity in higher animals, which means the recognition and development of personality. Is wasteful the term to apply to the existence of that teeming organic proletariat which is one of the primary conditions of personalities?

The view that there is a deep incongruity between the facts of the case and the possibility of religious interpretation has been forcibly stated by Professor Lovejoy, who does not, however, accept the conclusion. " Darwinism or the doctrine of natural selection declares these three unlovely aspects of the world—its wastefulness, its disharmony, and its cruelty—to be not simply casual details of the picture, but the very essence of that whole evolutional process which, regarded in its results and not in its methods, had seemed so admirable and so edifying to contemplate " (Lovejoy, 1909, p. 93). Whether the seamy aspects of Nature which the theory

of natural selection is supposed to bring into relief are really centrally significant and ubiquitous aspects, is, Professor Lovejoy admits, "a question which contemporary biology is diligently endeavouring to settle by its own proper methods. One can only say now that the dominant tendency is distinctly towards an answer in the negative" (1909, p. 95). We have tried to show that this dominant tendency is reasonable.

§ 9. *A Balanced View.*

These are not all the shadows by any means, but they must serve for illustration. In other studies we have seen that the struggle for existence is often an endeavour after well-being; not a miserable internecine squabble around the platter of subsistence, but including all the answers-back which able-bodied, able-minded creatures make to environing difficulties and limitations. We have seen that natural selection is neither altogether automatic nor in any case arbitrary, but is a discriminative sifting in relation to an established Systema Naturæ—a fact which helps to secure progressiveness. We have seen that variation is not haphazard nor fortuitous, and that heredity does not leave us stifling in a fatalistic atmosphere. We have seen that beauty is Nature's universal hall-mark on fully-formed, independent, healthy organisms, living in natural conditions. And lastly we have seen that many of the shadows become less perplexing when carefully scrutinised.

Our thesis is violently opposed to the view of some of the greatest thinkers. Aristotle, who knew Animate Nature with an intimacy insured by his genius and patience, spoke of the lack of order in Nature and likened it to what may

be seen in the life of a slave, to whom, on account of his low estate, certain license is permitted. Hegel, to skip about two millennia, compared Nature to a Bacchantic dance. We regard both comparisons as infelicitous. Indeed, we are not in the least inclined to accept the depreciatory views of Animate Nature which have been put into circulation. Many are obvious libels. There is some truth in Aristotle's dignified caution that Nature is dæmonic rather than divine,—but we reject as ignorant and impious Luther's brusque saying: "The world is an odd fellow; may God soon make an end of it." Is it unreasonable to suggest that those who allow themselves to be oppressed by the discords and disharmonies in the world without are in part themselves to blame for the weight of their burden, by remaining, more or less consciously, under the domination of the geocentric, anthropocentric, and finalist pre-conceptions of the Middle Ages, which regarded Man as the hub of the Universe?

In reference to the misery of catastrophes, like the Calabrian earthquake or the "Titanic" wreck, we venture to note how the apologetic problem changes with our changing outlook on Nature. Not many generations ago these calamities were directly and literally referred to "the hand of God"; under the conception of the reign of law "such acts are now regarded as acts of divine permission rather than of commission". No 'sceptic' would write of them now as Voltaire did of the Lisbon earthquake. Moreover, every one feels that it is not an orderly Universe if the laws of the strength of materials or of oceanic currents can be abrogated by mercy for individual lives. Without accepting an exaggerated view of the Uniformity of Nature as absolute, we know that within certain temporal and spatial limits we can trust to the regularity of frequently observed

sequences. It would be an intolerable world if there were loopholes for individuals even when the number of lives lost is tragic beyond any words. Many speak, rightly we believe, of the unity of 'purpose' working in Nature and its evolution, but do not the tragedies show us plainly that this word Purpose, though the best we have, must be used in this connection in a symbolic way, being Purpose with a plan larger than we can understand?

If our view of Animate Nature presented no difficulties, it would be justly regarded with suspicion. Truly, it presents difficulties. There is often lack of plasticity; there are imperfect adaptations; there are taxes on progress; there are many parasites; there is some suffering and many a domestic tragedy; there is the astonishing spectacle of the demolition of masterpieces that millions of years have gone to fashion; and there is often a note of wildness that startles us. No one can shut his eyes to the difficulties, our protest is against allowing them to blot out the sun. The plasticity, the adaptations, the progress, the inter-linkages, the joy, the happiness, the masterpieces, the note of gentleness, how they make the shadows shrink! Our thesis stands that the facts of an accurate Natural History are not incongruent with an interpretation of Nature in higher terms.

We have, moreover, to bear in mind that the evolution is still in progress, that organisms are still subduing the inorganic unto themselves, that the mind-body is still continuing its arduous task of subordinating the body-mind to its purpose, that we in facing and mastering difficulties are sharing in working out a better future for our successors. The ladder of evolution is often very steep and organisms may slip down into disintegrative phases, but the bigger fact is that the main trend of evolution is essentially integrative.

Who shall impiously prescribe its limits, especially in the Kingdom of Man, where Personality seems to be beginning to transcend Organism?

SUMMARY.

It is a defensible position that Animate Nature and its evolution are congruent with a spiritual or religious interpretation. A scientific view of the system of which we form a part cannot, indeed, prove anything about the value or significance of Nature, but it is not inconsistent with the idea that Nature may be a Divine creation. Perhaps this is even suggested by the beauty, the harmony, and the progressiveness of Animate Nature. But there are many shadows.

There is a notable lack of plasticity in highly adaptive organic structure, and if environmental conditions change, highly specialised types may perish because of their very perfection. Only in intelligent resourcefulness is there a way of escape. But every art is limited by its medium, and the extinction of types is often the nemesis of their long-continued stability. Moreover, the external vicissitudes have doubtless had a very important rôle in organic evolution. And even though lost races leave no direct descendants, some of their gains may be continued on collateral lines.

There are some cases where arrangements that are usually well-adapted are fatally inadequate in a crisis, as when the moth flies into the flame or the lemmings swim out into the sea. But adaptations must be, on the whole, in reference to normally recurrent routine, not in reference to very exceptional conditions; though as a matter of fact there are some adaptations which meet rare difficulties. Imperfection of adaptation is often illustrated when organisms are changing their habits or their habitat, and it would be a magical world if it were not so.

It is quite futile to try to make a cosmic shadow out of the frequency of disease. In natural conditions constitutional disease is unknown—if it arises it is not allowed to grip; and microbic disease—so common when Man interferes—is exceedingly rare in wild life.

Another shadow is the frequency of parasitism. Parasitic plants and animals are legion and almost no living creature escapes them. It is abhorrent that fine organisation should be spoilt, but many

parasites do their wonted hosts very little harm. Many parasites are repulsive in form, colour, and movements—the brand of their degeneracy. The drifting life of ease seems inconsistent with Nature's way of putting a premium on strenuous endeavour. But parasitism is, to begin with, a response to environing difficulties and limitations, the parasite can have little awareness of the significance of its step; its host is in most cases simply a promiseful area of exploitation; the parasitism often fades into symbiosis and commensalism; it is often resorted to by the mothers seeking a safe place for the young; it sometimes has a useful eliminative influence. That there is sometimes a hint of devilry in parasitism must be admitted, but there is great risk of fallacious anthropomorphism here.

Another reproach hurled at Nature is that of cruelty, which may be discussed along with parasitism since it refers to the nutritive chains that bind organisms together. That many animals prey on others is obvious, and this must sometimes involve suffering. Yet little is known of their pain, and, apart from a few difficult cases, there is no torturing.

Another shadow is that of senescence and death. But senility at least is not a disharmony in the realm of organisms, only in mankind. Growing old is a necessary tax on differentiation, for as a stable framework grows in complexity processes of rejuvenescence are bound to lag. In some simple creatures natural death is successfully avoided. "The conditions and processes in the human organism which lead to death in the end are the conditions and processes which make man what he is."

Oppressive to many is the apparent wastefulness. But the abundant multiplication of humble organisms affords a stable foundation on which a higher life has been based, and a truly marvellous working equilibrium wrought out. The scheme of Animate Nature is in great part a cycle of incarnations; it may attract or repel us, but it is not wasteful.

That there are shadows is admitted, but it is significant that they tend to disappear in the light of increasing knowledge. They do not force us to conclude that there is any radical incongruity between a scientific description and a religious interpretation of Nature.

LECTURE XIX.

THE CONTROL OF LIFE: LESSONS OF EVOLUTION.

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§ 1. *The Idea of the Controllability of Life.* § 2. *Heredity the First Determinant of Life.* § 3. *Nurture the Second Determinant of Life.* § 4. *Selection the Third Determinant of Life.* § 5. *Importance of Correlating Organismal, Functional, and Environmental Betterment.* § 6. *Dangers of False Simplicity or Materialism.* § 7. *Science for Life.*

A STUDY of human history which yielded no practical counsel to mankind would be self-condemned, and the same must be true of a study of animate evolution. What are the lessons of evolution?

§ 1. *The Idea of the Controllability of Life.*

There is practical suggestiveness in the very idea of organic evolution. Darwin changed a relatively static conception of the Realm of Organisms into an intensely dynamic one. The forms of life which seemed so fixed were shown to be in racial flux—though the movement might be as imperceptible as a glacier's flow. What Man could do in a relatively short time by breeding from selected variants was shown by his success with domesticated animals and cultivated plants. Thus the whole aspect of things was changed. The outlook became kinetic, and this led on naturally to the practical idea of *the controllability of life.* If flowers and pigeons and the like can be controlled, and controlled so well, then why not human life also? If Man can evolve

from out of a crab-apple all the treasures of the orchard, may he not replace sourness by sweetness in human character? If Man can evolve from out of a wolf-like creature the domesticated dog, the trusty guardian of his flocks, may he not hopefully try to evolve the wolfish out of mankind? A few Darwinians were indeed inclined to be too sanguine, overlooking the fact that all that Man did in his domestication and cultivation was to use with discretion the variational material which the organisms themselves put into his hands.

Moreover, investigation brought to light many instances of marked modifiability. So much can be done by training, by exercise, by dieting, by altering the surroundings that we cannot wonder that there was for a time an exaggeration of the transforming power of function and environment. The fact is, however, that what is expressed from within is much more important than what is impressed from without; the range of variability is much wider than that of modifiability. Moreover, we do not know that the individually acquired modifications of the parents can be entailed as such or in any representative degree on the offspring.

It was pre-eminently Pasteur who made the idea of controllability glow. He may be taken as type of the many illustrious investigators who have been inspired to great achievements by the idea of the biological control of life. Beginning with measures for getting rid of the silkworm disease, which was ruining the south of France, Pasteur proceeded to attack such terrible scourges as splenic fever and hydrophobia, and conquered by understanding them. With object-lessons on a grand scale he convinced every open mind that the days of folded hands and resignation were over, and that it was for Man, with Science as torch,

and with Mercy in his heart, to enter courageously into the fuller possession of his Kingdom.

It was the beginning of a new era for mankind, and it influenced thought and feeling as well as practice. If there be almost no constitutional disease in wild nature, why should it persist in mankind? Why should Man and his stock have a monopoly of senility? If certain microbic diseases can be got rid of, why do we allow them to linger in our midst? And we have, of course, practically ousted some terrors from their lairs, as in the cases of smallpox and typhus. If we cannot alter the span of human life, we can at any rate make sure what we shall *not* die of. The practical corollary of the doctrine of evolution is the controllability of life.

We have argued that Nature is crowned in Man, not merely because he has an all-round excellence of differentiation and integration, but especially because he is the finest expression of those qualities which mark the main trend of organic evolution,—such as freedom, awareness, mastery. Speaking metaphorically, we may say that Nature finds herself in Man, who understands, appreciates, and enjoys her in a sense that is certainly not true of the grazing herd. But the anomaly is that Man, minister and interpreter of Nature as he is, is subject to inhibitions and disharmonies which are not tolerated in wild nature. If there be an underlying purpose or meaning in organic Evolution, is not Man hindering it by his slowness to understand and fall in with the principles of its accomplishment? If the central fact in evolution be "the slowly wrought-out dominance of mind in things", it is surely man's fundamental task to use this expanding mind to control his own life. If the process of Evolution suggests any lesson, it is surely that "the sharpened life commands its course",—by brains, correlation,

organisation. At lower levels the organisation that succeeds may be reflex, tropistic, instinctive; for Man it must be intelligent, at least; rational, if possible. But what the evolution-process points to with firmness is that Brains pay—Brains that include Love as well as Logic.

§ 2. *Heredity the First Determinant of Life.*

The first determinant of life is the natural inheritance—the past living on in the present, often with something new superadded. Nothing seems further from the possibility of control than heredity: as the satirical poet observed, "a man cannot be too careful in the choice of his parents". But while we cannot choose our *parents,* we can, more or less, choose our *partners* in life, and this may mean controlling heredity. We cannot create a desirable variation by taking thought, but we may perhaps be able to prevent a very undesirable one from being continued. Parents have also some opportunity and responsibility in regard to the partners whom their children may choose. The days of coercion are over, but there is no coercion in the garrisoning (probably most effective when least direct) of the affections against the advances of the ignoble, the inefficient, and the hereditarily handicapped. This again means controlling heredity. The inheritance from the past is beyond control, except in so far as its expression may be influenced by nurture; but the inheritance handed on to the future is in some measure within control, since the mating of fittest with fittest, of fit with fitter, of fit with fit can be encouraged by common sense and good feeling, while the mating of fit and unfit, and of unfit with unfit can be discouraged. This has, of course, been done over and over again by peoples—such as the Hebrews—with pride of race and an enthusiasm for

vigour. But now it can be done with fuller and finer knowledge. Certain it is that there can be no secure progress which does not recognise that Heredity, the past living on in the present, is the first Fate, and the greatest of the three. "Bless not thyself," said Sir Thomas Browne, "that thou wert born in Athens; but, among thy multiplied acknowledgments, lift up one hand to heaven that thou wert born of honest parents, that modesty, humanity, and veracity lay in the same egg, and came into the world with thee."

§ 3. *Nurture the Second Determinant of Life.*

The second determinant of life is Nurture—all manner of environing influences, whether due to surroundings, or to use and disuse, or to the social fabric. This nurture is largely within control—especially for the more prosperous, or more enlightened, or more idealistically ambitious members of the community; and the fullness of expression that the inheritance finds in development depends in part on the abundance and appropriateness of the nurture. If the nurture be opulent the buds may blossom richly. Conversely, buds which are detrimental may be kept dormant if the appropriate wakening stimulus be withheld; and for the individual at least this may be well. More than a few of us may have to confess with the poet that we are "stuccoed all over with quadrupeds", including some reptiles; but, happily, these may remain in a starved state if we refuse them the appropriate nurture. Thus "the ape and tiger" in Man may die,—in the individual at least. It comes to this, that the controllability of nurture gives us some hold on the expression of our inheritance. We cannot alter the number of talents that we get to start with, but we certainly have some freedom in our trading with them. Not very

often can a man truthfully say that he was hereditarily compelled to put his inherited talent in a napkin and bury it in the ground.

As the result of well-chosen influences and strenuous discipline, an individual may acquire some desirable quality, —usually a nurtural modification of an inherent predisposition. Now, as we have seen, it seems unlikely that this sort of personal gain can as such get into the racial treasure-box. The possibility remains, however, of re-acquiring the gain in each successive generation; or, contrariwise, of saving a generation from a gratuitous loss. This is peculiarly important for Man, where the extra-organismal social heritage counts for so much in nurture, especially as regards the higher human qualities.

On another line of thought, it is doubtful whether those who are not accustomed to look at life biologically are quite aware of the value of variations. These new departures, idiosyncrasies, eccentricities, individualities, originalities are the most precious things in the world,—when they are on the upgrade. If we do not understand them we call their possessors cranks; if they are ahead of the race, yet appreciated, we speak of genius. In their finest human expression they mean reachings forwards to super-man. No one can offer a recipe for their production, but this practical point is clear, that, given a promiseful new departure, we may fail to make anything like the best of it if the nurture be not likewise evolving. Good nurture gives a progressive variation more chance of realisation, success, and transmission. It is a sad waste when a fascinating new plant is choked in a sluggard's garden. Nurture determines in part the sort of reception that a new variation meets with, and nurture consists in part of a subtle complex of liberating

stimuli, which are to our potentialities as sunshine and rain to buds. "As is the world on the banks, so is the mind of man." "What we have inherited from our ancestors we must put to use, if it is to become our very own." When a belief in the transmission of individually acquired somatic modifications was general, reformers tended to exaggerate the directly ameliorative value of good nurture. Now that the belief in the transmission of individually acquired modifications has been badly shaken, many thinkers have swung to the opposite extreme, and the rôle of nurture is depreciated. But its individual importance remains, and its indirect importance also.

Prof. Karl Pearson and his collaborators have concluded that "the degree of dependence of the child on the characters of its parentage is ten times as intense as its degree of dependence on the character of its home or uprearing". "It is five to ten times as profitable for a child to be born of parents of sound physique and of brisk, orderly mentality, as for a child to be born and nurtured in a good physical environment." It may be doubted, however, whether it is possible to discriminate so precisely between what is due to hereditary nature and what is due to available nurture. It is also important to inquire when the nurture is supposed to begin: there is much nurture before birth.

Since hereditary nature and liberating nurture are both essential, there is no rigid antithesis. Nurture is important as a condition of normal development, and on the richness of its liberating stimuli the degree of development in part depends.

Gudernatsch has shown that in tadpoles fed on thyroid gland there is differentiation without growth, while in tadpoles fed on thymus and spleen there is growth without

differentiation. A character *known to be* part of the inheritance may remain entirely unexpressed in the individual development because certain environmental conditions are lacking, yet the heritable character may be handed on all the same. Thus fruit-flies (Drosophila) of a Mendelian race with a peculiar abnormality may appear perfectly normal if raised in a dry environment, but the presence within them of the 'factor' for the abnormal feature may be demonstrated by rearing their offspring in a damp place. This shows the importance of nurture *for the individual.*

A diagrammatic illustration concerns the red Chinese primrose (*Primula sinensis rubra*). Reared at 15°—20° C. it has red flowers. Reared at 30°—35° C., with moisture and shade the same plants have pure white flowers like those of *Primula sinensis alba,* which always has white flowers. Thus we see that the development of colour in the red Chinese primrose depends on its nurture.

Take another illustration from the fruit-fly. There is a mutant stock that produces supernumerary legs, in considerable percentage in winter, few or none in summer. Miss Hoge finds that when the flies are kept in an ice-chest at a temperature of about 10° C., a high percentage of individuals with supernumerary legs occurs. In a hot climate there would be no evidence that the peculiarity was part of the inheritance; in a cold country it would be obvious. This shows that the expression of the inheritance as regards a particular character sometimes depends on nurture.

In estimating the importance of nurture for the individual man, we must remember how largely the human mind is a social product. As Prof. George H. Parker (1914) puts it, "Our intellectual outfit comes to us more in the nature of a social contribution than an organic one." Per-

haps it is going too far to suggest that as regards our minds we are more 'made' than 'born'; but this is certain, that while our mental capacities are primarily determined by heredity, they can be encouraged and augmented, or inhibited and depressed, *within wide limits,* by nurture.

On no account are we to countenance, if we can help it, spoiling good stock by bad, for that is the worst thing man can do. But we must beware of confusing veneer with hereditary nature. We must not too readily assume that people are as good as they look, or as bad as they look. In regard to the last, in an interesting study entitled *Environment and Efficiency,* Miss Mary Horner Thomson tells of her investigation of 265 children, mostly of "the lowest class" (Class A, fourth below the poverty level!), who had been sent to institutions and trained. She found that 192 (72 per cent.) turned out well; that 44 (16 per cent.) were doubtful; and that only 29 (less than 11 per cent.) were unsatisfactory, and of these 13 were defective. These figures, which should of course be checked and extended, afford some evidence of the controllability of the individual life.

Less extremely than some other Mendelians, Professor Punnett writes: "Hygiene and education are influences which can in some measure check the operation of one factor and encourage the operation of another. But that they can add a factor for a good quality or take away a factor for an evil one is utterly opposed to all that is known of the facts of heredity."

But a practical note may be here permitted. It is very difficult for us to know all that is in a man's inheritance. Indeed we cannot, for we can see only what is expressed, and the condition of expression is appropriate nurture.

Therefore in Man's formative periods the common-sense view is surely this. We cannot be quite sure what we have in our inheritance, therefore let us give every chance to such qualities as are liberated by ameliorative nurture. We cannot be quite sure what may not be in our inheritance, therefore we take no chances; let us avoid the kind of nurture that arouses sleeping dogs. The theory of the control of life is here quite plain: the practice, we admit, is no easier than before, save that we understand the issues better.

§ 4. *Selection the Third Determinant of Life.*

The third determinant of life is Selection, and this is of peculiar importance in the human sphere, where Natural Selection is largely in abeyance and the sifting is in great part rational and social. We call it rational and social because it is more or less deliberate and thought-out and because it is effected by social sieves; unfortunately this does not mean that it may not be terribly mistaken. In early days mankind was much in the sieve of Natural Selection—the meshes being wild beasts, changes of climate, scarcity of food, unchecked disease, and so on, and we are the better for that sifting to-day. But, as every one knows, the whole trend of human evolution since civilisation began has been to throw off the yoke of natural selection. Some of its thraldom remains, as in cases of differential death-rate, where the inherently weaker succumb in larger numbers, but we are continually interfering—necessarily and rightly—with the sifting operations of disease, hard times, and the like. This interference has been in great part prompted by the strengthening and diffusion of the humaner sentiments and a realisation of our solidarity; but it involves, as every one recognises more or less clearly, the terrible danger

of relaxed sifting. In regard to that the records of organic and social evolution are alike eloquent. No one has stated the dilemma more poignantly than Spencer: "Any arrangements which, in a considerable degree, prevent superiority from profiting by the rewards of superiority, or shield inferiority from the evils it entails—any arrangements which tend to make it as well to be inferior as to be superior, are arrangements diametrically opposed to the progress of organisation, and the reaching of a higher life." That way perdition lies. It is a dilemma of civilisation that we cannot tolerate Nature's régime, the individual life means so much to us; and yet we have not replaced it by any sufficiently strict, and consistent, and carefully thought-out sifting methods of our own.

There is satisfaction in healing the sick and preventing wastage of life; we cannot but try to alleviate suffering; but there is no gainsaying the danger of being cruel to future generations by being kind in the present. There is the undeniable risk of helping too much, of coddling the undesirable and unwholesome so that they get strength enough to multiply, often spoiling good stock with the infiltration of bad. The wheat may have too much sympathy for the tares, and societies for the amalgamation of heaven and hell do not commend themselves to the wise.

This is a large and difficult question—the transition from Natural Selection to some other kind of selection which will grip the germ-plasm. The following three considerations are submitted. (1) In a number of cases the diseases and miseries with which civilised man is successfully coping are *indiscriminate* in their elimination. They thin the ranks, but they do not weed out or sift. The checking of such diseases and miseries will not, therefore, especially encourage

the survival of types who are a source of weakness to human society. Hygienic endeavours which interfere with indiscriminate elimination—as in the case of much infantile mortality—may be pushed on unhesitatingly.

(2) As things are, there ought to be no question of drastic social surgery or of accepting Plato's proposals for the purgation of the state. For, on the one hand, we do not know enough to go far with safety, and, on the other hand, we are forbidden by the social sentiment of the most moralised types. What can be done is to work back to the old and wholesome pride of race, and to work away from whatever tends to encourage the multiplication of the diseased and the unwholesome. For a long time to come reformers will have enough to do along negative lines,—in seeking to prevent the spoiling of good stock with bad. Much may also be achieved by educating public opinion, replacing baseless prejudices by convictions founded on facts. It is not in the 20th century too much to ask that the quaint lists of forbidden degrees which used to be prefixed to copies of the Scriptures should be replaced by sound eugenic information.

(3) The commonplace must be borne in mind that man is a social person, and that what is biologically commendable may be socially disruptive. Many of those who are seriously handicapped by inheritance, and who ought not to be encouraged to have offspring, are in other respects valuable citizens. Many of the weaklings whom the social surgeon threatens are strong in spirit. As poets and artists, reformers and preachers, many of the weaklings have been among the "makers and shakers" of the world.

A useful office is the careful criticism of all the methods of discriminate elimination—whether deliberate or not—that are at work in mankind. Some economists have wisely

urged upon us the importance of criticism of consumption, for it is plain that in our expenditure we are willy-nilly selective. Thus a tradition of consistent expenditure along restricted materialistic lines must make for the elimination of artists, musicians, and similar types who are the salt of the earth. It condemns them to celibacy; it lets them slowly starve. Considerations of this sort may be exaggerated so as to make life a burden too heavy to be borne, but it is plain that a community which is spending solely on things that perish in the using cannot be on a sound line of evolution. All expenditure that consistently promotes unhealthy occupations rather than healthy ones, that helps to foster and multiply the feckless rather than controlled types, that makes for sweated labour and slums rather than for well-paid work and gardens, is necessarily anti-evolutionary. From founding celibate fellowships at colleges down to advertising for gardeners "without encumbrances", every form of selection that tends to prevent good types from duly contributing to the composition of succeeding generations is to be condemned in the court of applied biology, often called eugenics. That there may be a higher court of appeal is not denied.

An outstanding fact of Animate Evolution is, that new departures making for the welfare of the race become ingrained and entailed as part of the adaptive organisation of the creature. In the case of Man there has been a similar enregistration; it is idle to deny that there has been a hereditary organisation of kindliness, helpfulness, cheerfulness, and so on. But this hereditary organisation proceeds slowly, and so we must trust greatly to the extra-organismal heritage of traditions, conventions, ideals, and the like which works very potently both as a stimulating nurture, prompting us

to seek after virtue and understanding, and also as a selective agency, leaving us behind if we fail too utterly of what society expects of its members.

In education—intellectual, physical, and moral—we do of course habitually seek to utilise nurture in the widest sense which includes the social heritage—as a means towards making the most of the individual development, and what, it may be asked, have we to offer in the way of new suggestion? Simply this, that we might to advantage be more scientific and less vague; that we should utilise with resoluteness and conviction the suggestions which expert science has to offer in regard to manifold problems in the control of life. We are convinced that many of the so-called "cosmic shadows", such as the wastefulness of Nature, are misunderstandings; we are convinced that many of the shadows of human life are gratuitous, that they would be scattered if we let in more of the light of science. Our forefathers had to deal with these shadows in an indirect way or not at all; often the only thing to do was to try to get moral discipline out of them. But now we have made great advances towards understanding many of the human shadows, and it is only inertia that keeps us from directly dispelling them. Much is being done every day, but much more requires to be done, and our point is that the first and foremost lesson of evolution is: Let in more light,—more scientific light. Another lesson, of course, is: Let in more Love.

We know that a normal development of the human organism—in mind and body—demands an appropriate nurture; and yet we are implicated in human environments which are not up to the normal standard. In these environments, which make us ashamed, good men and women do indeed live, but there are surely many of the dwellers in

darkness who find the great task of happiness altogether too hard.

Similarly, in regard to functional fatigue, there is a very considerable body of experimental fact in regard to the profitable length of a school-lesson, the profitable length of a school-day, the profitable length of a working-day, but how slow we are to utilise expert advice. In regard to occupational fatigue it is well known that it is the last straw that breaks the camel's back, and that what gives a push towards the danger-zone is often the entirely remediable delay in procuring appetising food.

These are familiar instances which we use simply as diagrams of the sad fact that we have got so accustomed to folding the hands when we did not know what to do, that we continue our resigned acquiescence even when the path of effective action is clear.

Professor Ward has spoken warmly of what man may achieve by an increased control of life (*Realms of Ends,* p. 112). "What the schoolmaster, the physician, and the philanthropist effect for the amelioration of the masses needs no description. Here again we have definite direction overriding the random and untrained impulses of the natural man. While the progress already made in the physical and social ameloriation of human life is inestimable, it is as nothing compared with what is still possible. Nine-tenths of our physical ills are due to ignorance and perhaps a still greater proportion of our social evils are due to selfishness. Present scientific knowledge is adequate to remedy a very large proportion of the former, and the ordinary prudential maxims of utilitarian morality, if they were only observed as they might be, would go far towards extinguishing the latter: they would put an end to the worships of Venus,

Bacchus, and Mammon, if even they did not establish peace and chain up the dogs of war for ever." This was 1907-1910.

In the cases where the issue is relatively clear we have of course made great progress. We think of malaria and Malta fever, of diphtheria and plague, and many other diseases now coming under control. Not many years ago a number of religious and worthy Boer farmers—unconsciously impious—refused to join with an effective Anti-Locust League which depended for success on concerted action; they gave for their reason that it was attempting to stay the hand of God. But already this sounds like ancient history. Not in regard to diseases and pests alone, but in regard to depressing environment, ugliness, and dirt; in regard to dangerous and deteriorative occupations; in regard to poverty and unemployment, and, in short, all manner of objective evils, we have a determination rapidly growing stronger in our midst to get at the facts, to understand the operative factors, and to put brains into the task of betterment. Knowledge is foresight, and foresight is power. Science is for the amelioration and control, as well as for the enlightenment of life. To have this conviction strongly is surely to show no profane depreciation of the things of the spirit which are beyond the scientific universe of discourse.

It is the complaint of most of us that scientific efforts for the alleviation of misery and the scattering of gratuitous shadows move so very slowly. On the other hand, there is some reason to be afraid of movements that make people more comfortable without making them more ambitious in the quest for the True, the Beautiful, and the Good; and of reforms which save guilty people from the consequences of sin, selfishness, and sloth.

§ 5. *Importance of Correlating Organismal, Functional, and Environmental Betterment.*

A consideration of organic evolution suggests that progressive change depends on the correlation of functional and environmental with organismal improvement. We see writ large the lesson that a promising organisation may undergo involution in conditions of ease and safety, that the parasite is branded by degeneration, that unused organs dwindle away. We have seen that the development of characters is in some measure dependent on nurture, that progressive variations are apt to be short-lived unless the environment be also progressive, that the sifting is always in relation to a definite here and now—namely, the surrounding web of life in which some of the great advances of the past are always in some measure systematised. What is true of organic progress is yet more abundantly true of human progress, physical and social, as well as organic: that there must be a correlation of three kinds of endeavour,—that which aims at the improvement of the organism or breed (Eugenics), that which concerns itself with the ameloriation of the environment (Eutopias or Euthenics), and that which seeks to bring about the betterment of functions, especially occupations (Eutechnics). Different sides of progress appeal to different minds, and few of us can work effectively at more than one thing at a time, but perhaps we should give greater prominence than we do to the simple lesson of Evolution that lasting betterment must be realised in place and work as well as in people, in environment and function (including leisure-time activity) as well as in organism.

§ 6. *Dangers of False Simplicity or Materialism.*

When we turn to the consideration of practical problems, we reap the reward of the time devoted to the discussion of the essential characters of the living organism. The conclusion that the category 'Mechanism' requires in Animate Nature to be supplemented by the category 'Organism', warrants us in carefully scrutinising all proposals which are tarred with the mechanistic or materialistic brush. They are bound to be fallacious in their incompleteness and perhaps also in the clear-cut definiteness which makes false simplicity seductive.

The conclusion that, among the higher animals at least, we have certainly to do with mind-bodies or body-minds, with individualities having at least a rill of inner life, justifies us in looking with suspicion at projects which declare the uselessness of the soul. The "false simplicity" error of materialism may be repeated at a higher level in a biologism which leaves out mentality in its account and treatment of a dog, or in a theromorphism which treats men as "bipedal cattle"—often of considerable ferocity.

It is not merely a theoretical question of giving the most accurate description of a dog or a horse or a man, it is also a practical question of making the most and the best of the creature. And in this respect the conclusion of thoughtful experts is unanimous, that the truer conception is also that which works best.

There are many higher reasons (religious, ethical, artistic, and others) for taking a big view of Man, but what we have been concerned with in this course is to show that the crude view is bad science. When Prof. Jacques Loeb says, "We eat, drink, and reproduce, not because mankind has reached

an agreement that this is desirable, but because, machine-like, we are compelled to do so", he does not make a good antithesis. It is a familiar fact that Man often inhibits these organised impulses, and does so in reference to ideals which mankind has built up in a manner almost as far from the average animal's ways as these are from a machine's. When Le Dantec says, "The fact of being conscious does not intervene in the slightest degree in directing vital movements", we think that he is departing from the first canon of scientific work—accuracy. Often in man's experience it is just the being conscious that makes all the difference.

It may be useful to give two or three examples to show that proposals fundamentally biological need not be narrow or materialistic. Many authorities on education have emphasised on various grounds the importance of Play, but discussion passed to a firmer basis after the important work of Groos on the play of animals, for he showed that play was no mere safety-valve for superabundant energy and spirits, no mere relaxation, no mere recapitulation, but that it was a joyous apprenticeship to the business of life, a time for replacing instinctive predispositions by learning from experience, a time of elbow-room for variations, a time for experimenting before criticisms prune, before casualties induce caution, and before hard work brings on "life-harming heaviness."

Or again, it may be well for us, on our own behalf and for our children, to ask whether we are making what we might of the well-springs of joy in the world; and whether we have begun to know what we ought to know regarding the Biology or Psycho-biology of Joy. Have we given attention, for instance, to the work of the famous physiologist

of Petrograd, Prof. Ivan Petrovich Pavlov, who was the first to demonstrate the influence of the emotions on the health of the body? That a good circulation is associated with cheerfulness is a familiar fact,—and how this organic jauntiness sometimes jars on the tired and sorrowful! But there is the converse proposition that cheerfulness makes for health. It was said of old time: "he that is of a merry heart hath a continual feast", and "a merry heart is the life of the flesh". Now, what the researches of Pavlov, Cannon, Carlson, Crile, and others have done is to demonstrate experimentally that pleasant emotions favour the secretion of the digestive juices, the rhythmic movements of the food-canal, and the absorption of the aliment. Contrariwise, unpleasant emotional disturbance and worry of all sorts have been proved to have a retardative influence on the digestive processes. When the hungry man sees the well-laid table his mouth waters, but every one knows that a memory or an anticipation will also serve to move at least the first link in the digestive chain. "It is now well known," says Professor Dearborn, "that no sense-experience is too remote from the innervations of digestion to be taken into its associations, and serve as a stimulus of digestive movements and secretions." Emotion may influence the production of adrenalin by the core of the adrenal glands, and a slight increase in this potent substance constricts the smaller blood-vessels, raises the blood pressure, excites and freshens the muscles, increases the sugar content of the blood, and so on. From the non-mechanistic position which we have defended in these lectures, it is of great interest and importance that good news, psychical if anything is, may set in motion a series of physico-chemical and vital processes, complex beyond the ken of the wisest. And the

cheerful man, who cultivates the habit of happiness, finding good reasons for rejoicing—in the sunshine and stars, in flowers and birds, in works of art and the faces of his friends—will have his 'joy-reward' or euphoria added unto him unless he is fool enough to pursue it. Our point is, that, open to at least a large number of our fellow-creatures, there are sights and sounds that make for joy and that increasingly, as some of the Psalmists were well aware, and that one of the obvious lessons of evolution—and of common sense—is that we should use these well-springs freely.

What is true in regard to digestion applies also to other functions. Wordsworth knew this when he spoke of his heart responding to the sight of the rainbow and the recollection of the daffodils by the lakeside. He may not have known much about the complex pathways of the pneumogastric, but he was sure about the influence of joy on the circulation. Professor Dearborn has worked at the factors altering blood-pressure and he makes the notable statement that in the "general stimulation of the essential circulation in all constructive parts of the body, such as the brain, the muscles, and the digestive organs, joy exerts one of its most conspicuous benefits, and one that no one can doubt or ignore".

There are facts which point to the conclusion that a gladsome mind may also increase the integrative function of the nervous system. It is an indubitable fact that a joy—say of maternity, or discovery, or artistic creation—may become an exhilaration and enthusiasm of thought and will; but the same is true of bodily welfare. Good tidings will invigorate the flagging energies of a band of explorers; an unexpected visit will change a wearied homesick child, as if by magic, into a dancing gladsome elf; a religious joy

will make men and women transcend the ordinary limits of our frail humanity. How it comes about is not yet quite clear; but somehow the oil of joy, as the Scriptures call it, operates so as to make the limbs more supple and the face to shine. Emotion has its physical accompaniment in motions throughout the body, in changes in secretion and circulation, and also in some other way whereby influences from some emotional 'centre' such, perhaps, as the optic thalamus (the second great division of the brain) surge up into the cerebral cortex, the seat of the higher mental processes, where joy and activity may be correlated.

We have referred to recent work on the physiology of joy simply as an illustration of the way in which science may be utilised in the control of life—not merely as regards exercise, fresh air, diet, and so on, but in the subtler task of developing the personality on what one may call direct lines.

The danger ahead is well known, that, just as the direct pursuit of health is apt to engender hypochondria and valetudinarianism, and just as the direct pursuit of happiness is apt to defeat its own end, so the direct pursuit of joy for the sake of the 'joy-reward' may prove consummately futile. But it is possible to make a bogey of this risk. We are not made of such friable material.

Forced cheerfulness is, of course, a horror, but the persistent will to be glad, if worthily satisfied with some of the real joys of life, may soon become a habit that requires no artificial stimulation. A conventional approach to Nature and Art is often rewarded much beyond its deserts, and men who began by taking walks for duty's sake have often become genuine enthusiasts for the open country. The pursuit of joy may be futile and the faking of it an abomina-

tion, but there is nothing absurd or morbid, for instance, in humbly learning to know more about the endless things of beauty which are joys for ever. If we make sure of these, the euphoria will look after itself.

It is surely for the guidance of youth to recognise that at levels far below Man's there is an enhancing of physical fondness by æsthetic embroideries and emotional tenderness, and the sobering of all by a working together of mates in the discharge of parental duties.

It is surely for the guidance of all to realise the extent to which animal life rises above a struggle around the platter of subsistence, and illustrates the raw material, at least, of domestic virtues. We cannot believe that animals "think the ought", so that in the strict sense the ethical note is not sounded, but when we consider their expenditure of energy towards results that are other-regarding not self-regarding, we seem to hear an ethical undertone. In any case it is not from Natural History that we learn the "Might is Right" doctrine.

§ 7. *Science for Life.*

Let us sum up the general argument.

(1) There is no doubt whatever that many of the human shadows that blot out the sun and make our feet stumble are *gratuitous,* and may be got rid of whenever man pleases. That this condition, "whenever man pleases", is not easily fulfilled we are well aware. But there is no doubt that we can get rid of many social handicaps, and go on to higher adventures, discovering more and more of the goodness of God in the land of the living.

A hundred years ago people shuddered at the name 'Gaol-fever', a terrible pestilence, which attacked judge and jury,

prisoner and onlooker at Old Bailey. We call it typhus-fever now, and it is rare in Britain, thanks to the enthusiasm of the early nineteenth-century hygienists. It is a dirt disease, it can be controlled by care and cleanliness. It is due to a microbe, not yet isolated, which is transferred from man to man by infected lice. As Sir Ray Lankester says, the Angel of Death they spoke of a hundred years ago is the clothes' louse, which can be readily exterminated by the use of benzine. We cannot but feel that it was almost contemptible to have submitted for centuries to a tyranny of dirt; but the point is that we are continuing to submit to similar things. We are slow to gird up our loins. We are slow to learn the lesson of the Control of Life.

(2) It has been said that there are two views of this world, that which regards it as a swamp to be crossed as quickly as possible, and that which regards it as a marsh to be drained. The view to which our study of Animate Nature points is emphatically the latter. Man must continue the struggle against inhibitants,—the campaign in which living creatures have been engaged for millions of years, the endéavour to bring the inorganic into the service of the organic, to bring the body-mind into subordination to the mind-body, to eliminate the disorderly, the inharmonious, the involutionary. For we adhere to the thesis that evolution is *on the whole* integrative, not disintegrative.

(3) To put the same thing in a third way, which is more generalised, we are in profound agreement with the view well expressed by a contemporary philosopher,—that it is Man's part to build up, as he is doing, a scientific systematisation of knowledge which will form the basis of an increasing control of life. The mundane goal of the evolutionary movement is "the mastery by the human mind of the

conditions, internal as well as external, of its life and growth. The primitive intelligence is useful to the organism as a more elastic method of adjusting itself to its environment. As the mental powers develop, the tables are turned, and the mind adjusts its environment to its own needs. "*Mihi res non me rebus subjungere conor*" is the motto that it takes for its own. With the mastery of external nature, applied science has made us all familiar. But the last enemy that man shall overcome is himself. The internal conditions of life, the physiological basis of mental activity, the sociological laws that operate for the most part unconsciously, are parts of the 'environment' which the self-conscious intelligence has to master, and it is on this mastery that the *regnum hominis* will rest" (Hobhouse, 1915, p. 443). Of a truth, Science is for Life, not Life for Science.

SUMMARY.

The theoretical doctrine of evolution has for its practical corollary the fact of the controllability of life. Darwin was logically followed by Pasteur.

If the central fact in evolution be "the slowly wrought-out dominance of mind in things", it is surely man's fundamental task to use this expanding mind for the fuller possession of his kingdom, and the better ordering of his life in it. If evolution suggests any lesson it is this. We must inquire, therefore, into the determinants of life.

The first determinant of life is heredity—our relation to preceding generations—which includes not only the past living on in the present, but new departures or variations. We cannot alter our own inheritance, though it is ours to trade with, but we have some measure of control over the inheritance of future generations.

The second determinant of life is nurture—all manner of formative influences from surroundings and from use and disuse—and this is largely controllable in our hands. Nurture determines the fulness of expression that hereditary characters may attain in

development; it may re-impress desirable modifications on successive generations; it determines in part the sort of reception a new variation meets with. In mankind 'nurture' includes the 'social heritage'.

The third determinant of life is selection, and this is of peculiar importance in mankind, where natural sifting is largely in abeyance, where the sifting is in great part deliberate, rational, social. The relaxation of natural selection is the inevitable result of the increase of solidarity and sympathy; the difficulty is to find a sufficiently stern substitute. It should be noted that humane interference with indiscriminate elimination (which thins without sifting) cannot harm the race; that drastic social surgery is impossible in the present state of science and social sentiment; and that proposals which are sound biologically may be disruptive socially.

A study of animate evolution points to the conclusion that secure progress implies a correlation of organismal, functional, and environmental improvements. This is even more true as regards progress in the kingdom of man.

The hard-won conclusions that in Animate Nature the category 'mechanism' requires to be supplemented by the category 'organism', and that among the higher animals at least this requires to be supplemented by the conception of 'mind-body' (and in mankind by that of social personality), afford a test for practical projects. The error of materialism (namely, false simplicity) is often repeated at a higher level in biologism and theromorphism. The error is not in theory only, but shows itself in practice when the problem is to get the most or the best out of the creature.

It is very interesting to consider the extent to which animal life rises beyond a struggle around the platter of subsistence, and illustrates the raw material, at least, of domestic and social virtues. In the strict sense it may be true that the ethical note is not sounded, but there is often an ethical undertone. Nature has stamped this with her approval, Huxley notwithstanding.

LECTURE XX.

VIS MEDICATRIX NATURÆ.

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§ 1. *Biological Aspects of the Healing Power of Nature.* § 2. *Psychological Aspects of the Healing Power of Nature.* § 3. *Correspondence in Animate Nature to our Ideals of the True, the Beautiful, and the Good.* § 4. *Humanist Value of the Study of Animate Evolution.* § 5. *Scientific Description of Animate Nature Not Inconsistent with Religious Interpretation.*

§ 1. *Biological Aspects of the Healing Power of Nature.*

IN many different ways Man has realised the healing power of Nature—*vis medicatrix Naturæ*—and all of them are instructive. One might refer, for instance, to the healing virtues in many natural substances, both animal and vegetable, some of which are extraordinarily quaint. It has been re-discovered in modern times that more than one snake carries in its gall-bladder a sure antidote to its own venom. Is not the old advice that the coward should eat of the heart of a lion, so that he might be brave, echoed in the modern treatment of a cretinoid child with the thyroid gland of a sheep? Is it not like a leaf out of an old book of magic to read that an enlightened use of pituitary extract enabled a successful examinee to add in a short time to his height the couple of inches that were required in order to secure a post for which he had proved himself otherwise eligible? It looks as if by taking sufficient thought one might be able to add a cubit to one's stature.

Interesting too is the reparatory power exhibited by many living creatures. One of the Big Trees or Sequoias which

was a seedling in 271 B.C., suffered a burn three feet wide when it was 516 years old, and spent 105 years in folding its living tissues over the wound. When it was killed at the age of 2,171 years, a Methuselah among trees, it was engaged in healing a third great wound 18 feet wide and about 30 feet high. *Vis medicatrix Naturæ.*

A sponge can be cut up and planted out like a piece of potato-tuber; it may be minced and pressed through a cloth sieve without losing its power of regrowth. An earthworm thinks nothing of regrowing a new head or a new tail, or a snail its horn and the eye at the tip, even unto forty times. And this regenerative capacity is in the main adaptive in its distribution, for, as Lessona and Weismann have shown, it tends to occur in those animals and in those parts of animals which are in the natural conditions of their life peculiarly liable to non-fatal injury. Long-legged and lanky animals like crabs and starfishes usually show much of it; a self-contained globular animal like a sea-urchin shows little. The chameleon is one of the few lizards that does not regrow a lost tail, for, as it keeps it safely coiled around the branch, the regenerative capacity has fallen into abeyance.

Many other instances might be given of Nature's healing power:—the processes of rejuvenescence which in many organisms are continually at work in staving off senescence; the natural defences of organisms, such as the bodyguard of migratory phagocytes which deal with intruding microbes, and the mysterious intrinsic counter-actives or anti-bodies which deal with toxins; the immunity which some animals have to poisons, as the mongoose to snake-bite; the regulatory processes which sometimes occur when development or normal function is disturbed; the absence of disease and senility in wild life; the way in which some simple animals evade

natural death altogether; the numberless arrangements for keeping the earth clean and sweet; the hygienic value of sunshine and fresh air.

These matters lie outside our proper theme, but they are well worthy of being recalled. Even when one is able to give a reasonable account of how they have come to be, they illustrate the balance and adaptiveness which is characteristic of Animate Nature. Only a system with order and progress in the heart of it could elaborate itself so perfectly and so intricately. There is assuredly much to incline us to "assert Eternal Providence, and justify the ways of God to Men".

§ 2. *Psychological Aspects of the Healing Power of Nature.*

Let us think, however, of the way in which Nature contributes to the hygiene and healing of our minds, so apt to be disturbed by the rush and racket of civilisation. There are deeply-rooted, old-established, far-reaching relations between Man and Nature which cannot be ignored without loss. Man was cradled and brought up in touch with Nature, and he must ever return to her, like the wandering birds whose life is never full until, moved by an organic homesickness, they come back to nest in the place where they were born. In a period of evolution which has been mainly urban, we miss our contact with the open country, which is, for many, a condition of full sanity, and makes for the steadying and enrichment of life.

Especially in youth is touch with Nature invaluable, for it remains true of the child who goes forth every day that "what he sees becomes part of him for a day, or for a year, or for stretching cycles of years". It seems a pity that the modern child is often unfamiliar with the Scriptures;

it is also to be deplored that he is often equally unfamiliar with the book of Nature.

Man needs to sojourn with Nature in order to get certain fundamental impressions without which he is impoverished, —the impressions from the starry sky, the pathless sea, the mountain-top, the dense forest, the apple-blossom, the ant-hill, the swallows flying south in autumn. Man cannot safely dispense with the fundamental impressions of power, of largeness, of pervading order, of omnipresent beauty, of universal flux, of intricacy, of growth, of the web of life, of adaptiveness, of evolution. Some minds weary of theories; let them by sympathetic observation hug the facts close, for thus also may deeper visions of reality be gained. Let them by observation draw water from what an expert naturalist has called "the bottomless well of surprises" (Chalmers Mitchell, *Finite Life and Individuality*, p. 60).

Another healing virtue in Nature is to be found in its perennial problem-setting interest. It arouses our attention; it intrigues the curious spirit; it leads us on and on like the tales of the *Thousand and One Nights*. As some one said, it is like a serial story. Its study is a brain-stretching exercise, and while it rewards the discoverer with both light and power, it subjects him to a discipline which engenders humility. For is not all our science rounded with mystery —mystery as to essences, mystery as to origins, mystery as to mutations. What we are surest of is the fundamental mysteriousness of Nature.

§ 3. *Correspondence in Animate Nature to our Ideals of the True, the Beautiful, and the Good.*

There is a legitimate scientific sense in which it may be said that Man is not only a part, but a product of the system

of things and creatures that we call Nature. We know, indeed, that the system in its subjective expression is of Man's making; we know also that Man was made by the system. This is a familiar riddle. Needless to say, however, the system cannot mean to us a mindless kaleidoscope, for by no jugglery can one evolve mind out of anything else. But keeping to the common-sense view that Man is of a piece with a real external Nature, though transcending it when he will, we are concerned to point out that Nature is not altogether so foreign to Man as is continually insinuated.

The highest values for Man are the True, the Beautiful, and the Good; and it is of interest that there are in Nature features which do in some degree correspond to these. For it is not far-fetched to recognise that there is a rationality in Nature which is there to be discovered or discerned, which is not simply imposed upon Nature by our formulation. In what sense can we speak of a rationality in Nature? We mean that the system of things is more or less intelligible and explicable, that its relative uniformities can be trusted to, that when we get a grip of things we can make a coherent scientific system of them, which fits in with other parts of our intellectual systematisation. The formulation is sometimes premature and forced, but this is discovered in time, for Nature does not humour the inquirer. The Ptolemaic system in astronomy had to yield to the Copernican, that to the Keplerian, that to the Newtonian, and so on, but each advance meant getting nearer the truth, as we know by the increase in consistency on the one hand, and by the increase in the astronomer's power of prediction on the other. This would not be possible did not scientific formulation approximate towards a description of what actually happens.

That Nature is amenable to scientific formulation—dis-

cerned rather than imposed upon it—is admitted by all, but the interpretation is as difficult as the fact is obvious. It is a philosophical problem, but a scientific note may be permitted. To be asked how the marvellous fabric of science, one of the greatest human achievements, is to be explained in terms of evolutionary formulæ, is like being asked to account for the evolution of some very complex and relatively perfect structure like the human eye. Such questions have to be treated historically. Science and the eye must be looked at as the results of long processes of evolution, vastly older than Man. We trace the eye back to simple clusters of sensory cells, and we trace science back to simple practical lore, and further back still to pre-human capacities of learning. The acquisition and the expansion of the early lore had assuredly survival value; inborn curiosity has been from first to last a stimulus to inquiry; registration of gains in language and records, in instruments and permanent products, has made compound-interest advance possible. The result is not less admirable because its early stages were humble; but to ignore the early stages is to make the Ascent of Man magical.

But this does no more than give setting to the metaphysical problem. The strands of naturally-determined sequence have woven themselves into an intelligible pattern which science discerns; is it conceivable that they might have tied themselves into a knot baffling all disentanglement? And we must remember that almost all the discernment of the order of Nature has depended on seeing the stars in unbeclouded skies. Various attempts, such as Lachelier's (1871), have been made to explain the 'correspondence' between the intrinsic order of Nature and Man's capacity for deciphering it, but it seems doubtful if we get beyond

some device which dissolves rather than solves the problem. It looks like a frontier-problem for Man's intellect.

But, leaving this puzzle, do we not find some quiet for our unrest in the progressive disclosure of the orderliness of Nature? Ours is no phantasmagoria of a world, but a Systema Naturæ. We are parts of a reasonable world, which voices reason and listens to reason. Its process has worked persistently towards masterpieces, of which the climax is the reasonable soul. From the intrinsic order and intelligibility of Nature, which the rise of the magnificent scientific edifice proves, we may not be logically permitted to make a transcendent inference to an Omniscient Creator, but it is in that way the heart of Man points. Our belief is that the Logos is at the core of our system, implicit in the nebula, as now in the dew-drop. It slept for the most part through the evolution of plants and coral-like animals, whose dream-smiles are a joy for ever. It slept as the child sleeps before birth. It became more and more awake among higher animals,—feeling and knowing and willing. It became articulate in self-conscious Man,—and not least in his science.

Scientific re-constructions are not arbitrary projections, for they work. In this sense there is rationality in Nature. But if there is rationality in Nature, must we not go further? For, as Aliotta has put it, "He who believes in the objective value of his science must then also believe in God. If an absolute thought does not exist, Nature cannot be rational". Descartes rested his belief in Science on his belief in God. In his Gifford Lectures Mr. Arthur Balfour rested the belief in God on a belief in science, for "God is himself the condition of scientific knowledge".

To some it may seem far-fetched to find in Animate Nature a correspondence to Man's truth-seeking. But we

would point out, (1) that knowing is on the way to truth, and the knowing creatures, that face the facts, survive; and (2) that truth-seeking expresses the natural activity of the healthy mind, and Nature is all for health.

But it is also part of the deepest life of Man to enjoy what is beautiful, and one of the glories of the universe is its beauty. There is no place where this voice is not heard unless Man has obtruded noisily. Æsthetic emotion thrills what is best and highest in us, and it also makes the protoplasmic stream sing as it flows. The correspondence is never disappointing; and those who ask most are best satisfied. Part of the sensory delight that we have in beautiful sights in Nature may be due to Man's familiarity with them for so many hundreds of thousands of years; but this will not explain the correspondence that there is between the beauty of Nature and the ever-changing requirements of what we may call the 'spiritual eye'. In the contemplation of the supremely beautiful there is something of the satisfaction which religious feeling finds in music—a language expressing the inexpressible.

The system to which we belong is more or less intelligible, we can make good sense of it; it is beautiful through and through; but in what possible sense can it be said that there is in it anything corresponding to what we call good? If we patiently consider this question, two sets of facts present themselves. In the first place, Man began with strands of personality of pre-human origin, and some of these must have been very fine and others very coarse. We are apt to think oftener of the latter, for it is sometimes to our dismay and perplexity that they show themselves in the fabric of our life.

But do we think enough of the other side, that there must

have gone to the making of Mankind some very fine pre-human materials—kin-sympathy, parental affection, the love of mates, some power of control and of endurance, some grit, and some gentleness. There are some springs of conduct in us that were flowing long before our race began, and while the water of some is bitter, that of others is sweet.

The second consideration is that a study of the evolution-process discloses a multitude of cases in which the reward of success is given to types which are careful parents, devoted mates, friendly kinsfolk. There is abundance of elbowing and jostling, but many who have consulted Nature have turned away before she has finished speaking. We do not say that the extraordinarily laborious insect-mothers are ethical agents; that would be a confusion of thought; we say, however, that the objectively altruistic type succeeds. Nature stamps not only the beautiful, but the other-regarding with the only approval which is hers to bestow—success in surviving. And, unless they are uncommonly good hypocrites, many of Life's children behave as if they found living good.

Thus Nature speaks to our moral as well as to our intellectual ear. Singling and sifting never cease, but Nature has certainly another counsel besides whetting teeth and sharpening claws. The limitations and difficulties which enforce struggle and competition are often effectively transcended by increasing parental care and sociality. Nature is continually taking advantage of her children's capacity for self-forgetfulness. In many races of animals success has been the reward of subordinating individual interests to those of the species. As a matter of fact, an extraordinarily large part of the energy of organisms is spent not on themselves, but for others. Nature, we think, stamps not only

the beautiful but the good with her approval; and when we carefully consider the process of Natural Selection itself, do we not get from it a deep and ancient ethical message—that the individual must be content to subordinate himself to the species, even to lose himself in its progressive life? There is an ethical undertone.

§ 4. *Humanist Value of the Study of Animate Evolution.*

Nature's music does not cease on a merry chord, but perhaps it has a healing power. There is at all events, a tonic virtue in contemplating the evolutionary process of which mankind is an outcome. It is not a small thing, forsooth, that we are part and parcel of an Order of Nature which has evolved for millions of years like a long-drawn-out drama to finer and finer issues; that the process of evolution has in the main "the unity of an onward advancing melody"; that all through the ages, apart from blind alleys, life has been slowly creeping—and sometimes quickly leaping—upwards; that while there have been many mysterious losses even of branches from the great arbor vitæ, the flowers have become consistently finer. There was a time when there were no backboned animals; then fishes appeared, then amphibians, then reptiles, then birds and mammals, and then, after various tentatives, mankind—each age transcending its predecessor.

As we look back, then, on the world-becoming, we see that finer and finer actors have appeared from epoch to epoch on the crowded stage, and the situations have become more and more intricate. A great web has been passing for incomputable ages from the loom of time—hunger and love its warp and woof—but the pattern has become more and more subtle, and it sometimes seems as if it were picturing a

story. Is there not meaning in the long-drawn-out but indubitably progressive evolution of the nervous system, in the increasing elaboration of behaviour, in the gradual emancipation of the psyche? The bird is more of an agent than the worm—more of a free agent; and the world has greater value to the bird than to the worm. Some simple creatures have only one answer to every question; but how complex is the life of the ant on the instinctive line of evolution, and of the dog on the intelligent line. Since the beginning of life there has been a growing appreciation and mastery of the world. Is it going to stop?

Perhaps no one has yet fully appreciated what may be called the principle of conservation in evolution. In a very literal sense, the higher animals are heirs of all the ages. Let us explain. Organisms have evolved by a trial-and-error method; they experiment organically, instinctively, and intelligently; above all, perhaps, in the mysterious antenatal life of the germ-cells they experiment in self-expression—just as water vapour does in snowflakes, but far more subtly. What are called variations and mutations in biological language are the organism's experiments in self-expression, and these are the raw materials of progress.

But, while the organism is ever making tentative suggestions and searching its environment with its tendrils, it is also remarkably conservative. It proves all things, but the other side is, that it holds fast that which is good. Great gains once made are not held lightly. Species become extinct and races perish, but important organic inventions are carried on by some collateral lineage. It was probably some ribbon-worm that first manufactured hæmoglobin—the all-important, oxygen-capturing red pigment of the blood. Many backboneless animals of higher degree on different lines of

evolution have not got it, but the invention was too good to lose; and every one knows that all backboned animals from fishes onwards have red blood. Or again, the most primitive and in a way most puzzling kind of locomotion is that of the amœba flowing along, or rolling along—like a microscopic 'tank'—in the pond. Is it not a most suggestive fact that our health from day to day, and the development of our nervous system, are absolutely dependent on this self-same amœboid movement? Our white blood-corpuscles are amœboid cells; the outgrowth of nerve-fibres in development is in some measure due to amœboid movement. How far this evolutionary conservation of values goes, who shall say? In any case there seems good reason for regarding evolution as essentially integrative. By this we mean that it makes for co-ordination, consistency, harmony in the continual self-realisation of multitudinous forms of being. Ugliness, evil, inconsistency are disintegrative lapses that perish; beauty, goodness, truth—even in little bits—are integrative qualities that last. In any case, the big fact is, that men, bent on making much of their life, have behind them an organic momentum which is in part in line with what the best in us regards as best.

Purpose and promise. When we consider the grandeur of the long-drawn-out Evolution process and the wonder of its masterpieces, and especially when we realise its general progressiveness and its conservation of great gains, two ideas rise in the mind—purpose and promise.

It is difficult to shut out the impression that Nature is Nature for a purpose. We do not think any longer of a 'directive power' outside of the evolving organisms, but of a directive power which is bone of their bone and flesh of their flesh,—a directive power analogous to that which

we ourselves know when we command our course or send an arrow to its mark. What we must particularly take account of is the main trend in evolution, making persistently for the dominance of mentality and the establishment eventually of personality. Whether what we now experience be the goal or near the goal, it gives significance to the whole long journey. And if Man be the highest product of evolution, and if the central reality in our life is our clear purpose, may we not ask whether there is not also a purpose at the core of the world-process? Von Baer, the founder of embryology, remarks that the naturalist is not precluded from asking "whether the *totality* of details leads him to a general and final basis of intentional design", and our foregoing discussions have led us to the conclusion that a scientific description of Nature is not inconsistent with a philosophical or religious interpretation in terms of purpose which manifests itself in the order of Nature, in keeping Nature in lasting remembrance. We must, however, recognise that just as Man's conceived purpose transcends the mammal's perceived purpose, as that in turn transcends the lower animal's ingrained or organised purposiveness, so, but much more, will the Divine Purpose transcend our highest thoughts of it. But we deem that if we err in using the word Purpose—the biggest word we have—we err less grievously than if we used no word at all.

Promise. For millions and millions of years there was throughout Nature no voice of life at all—nothing to break the silence but the thunder and the cataract, the waves on the shore, and the wind among the trees. The morning stars sang together and the little hills clapped their hands, but there was no voice of life at all. The long lasting silence was first broken by insects, but they never got beyond in-

strumental music. It is to the progressive Amphibians of the Carboniferous Age that we must look back with special gratefulness, for they were the first to get vocal cords, and, interestingly enough, a movable tongue. With them Animate Nature found a voice.

In a much deeper sense, however, we may say that for millions and millions of years Nature was speechless—never more than groaning and whispering, as it were. It was in Man that Nature became definitely articulate; that the inherent rationality was echoed. In poem and painting Man expresses his æsthetic appreciation and partial understanding of the system of which he forms a part; in his science he turns darkness into light; in the application of science he conquers and controls the world.

Every one recognises as a big fact of animate evolution the growing differentiation and integration (*i.e.*, organisation) of living creatures, but another side to it is the progressive external registration. There has been woven a web of life whose pattern has become more and more intricate, as for instance in the inter-relations between flowers and flower-visiting insects. This complexifying of inter-relations has been of great importance in evolution, for it is in reference to this external system that experiments are tested or even made, and that selection works. Thus, as it seems to us, the intensification of life has been in part secured and in part prompted by the growing complexity of the external Systema Naturæ. Thus living creatures contribute to the evolution of their kind not only directly by exhibiting variations and by personally testing these, but also indirectly by making new patterns in the web of life. If this be so, there is for Man the hint—the Open Secret—that progressive evolution depends not merely on the improvement

of the natural inheritance, and on the intensification of the individual life, but also on the ennoblement of the external heritage—so much his own creation—the treasures of literature and art, the beautified region and city, the tradition of high ideals, and the multitudinous linkages—many in sad need of amelioration—in the framework of society itself.

In this mood we recall Emerson's famous passage: "So shall we come to look at the world with new eyes. Nature is not fixed . . . Spirit alters, moulds, makes it. Build, therefore, your own world.

"When a faithful thinker, resolute to detach every object from personal relations, and see it in the light of thought shall, at the same time, kindle science with the fire of the holiest affections, then will God go forth anew into the creation."

"As fast as you conform your life to the pure idea in your mind, that will unfold its great proportions. A corresponding revolution in things will attend the influx of the spirit. So fast will disagreeable appearances, swine, spiders, snakes [of course these words are used metaphorically, not zoologically], madhouses, prisons, enemies, vanish. They are temporary and shall be no more seen. The sordor and filths of nature, the sun shall dry up, and the wind exhale. As when the summer comes from the south, the snow-banks melt, and the face of the earth becomes green before it, so shall the advancing spirit create its ornaments along its path, and carry with it the beauty it visits, and the song which enchants it; it shall draw beautiful faces, warm hearts, wise discourse, and heroic acts, around its way until evil is no more seen. The Kingdom of man over nature, which cometh not with observation—a dominion such as now is beyond his dream of God—he shall enter without more

wonder than the blind man feels who is gradually restored to perfect sight."

Putting what we have said in a different way, we may speak of the three voices of Nature, meaning the impulses that come from the threefold—practical, emotional, and intellectual—relation between Man and Nature. These are the wordless voices referred to in the XIXth Psalm: "Day unto day is welling forth speech, and night unto night is breathing out knowledge; there *is* no speech, and there *are* no words; their voice has no audible sound; yet it resonates over all the earth." The three voices are: Endeavour, Enjoy, Enquire. The first voice is Endeavour. What would our hereditary character be without Nature's millennial sifting of the insurgent, the adventurous, the controlled, the far-sighted, the strenuous? And the discipline is still binding. There is no doubt as to Nature's condemnation of the unlit lamp and the ungirt loin. One of the obvious lessons of evolution is the danger of having things made too easy!

The second voice is Enjoy. As we come to know Nature, we find that everything is wonderful. "You of any well that springs may unfold the heaven of things." "It is enough if through Thy grace I've found naught common on Thy Earth. Take not that vision from my ken." As we begin to feel more at home our wonder grows into what may almost be called affection. This is true of those who have what Meredith called "love exceeding a simple love of the things that glide in grasses and rubble of woody wreck". Science never destroys wonder or delight, but only shifts it higher or deeper. As Coleridge said, "All knowledge begins and ends with wonder, but the first wonder is the child of ignorance, while the second is the parent of adoration." We need to listen to this second voice which says Wonder, Enjoy,

Revere. It was one whose life was far from being all roses who said:

> To make this Earth our hermitage,
> A cheerful and a changeful page
> God's bright and intricate device
> Of days and seasons doth suffice.

The third voice is Enquire: From the first Nature has been setting Man problems, leading him gradually on from the practical to the more abstract. Lafcadio Hearn tells us that in the house of any old Japanese family, the guest is likely to be shown some of the heirlooms. "A pretty little box, perhaps, will be set before you. Opening it you will see only a beautiful silk bag, closed with a silk running-cord decked with tiny tassels. . . . . You open the bag and see within it another bag of a different quality of silk, but very fine. Open that, and lo! a third, which contains a fourth, which contains a fifth, which contains a sixth, which contains a seventh bag, which contains the strongest, roughest, hardest vessel of Chinese clay that you ever beheld; yet it is not only curious but precious; it may be more than a thousand years old." Indeed it is more than clay, there is an idea in it.

Natural Science has to do with a similar process of unwrapping—it opens the beautiful box, it removes one silken envelope after another, trying at the same time to unravel the pattern and count the threads—and what is finally revealed is something very old and wonderful—the stuff out of which worlds have been spun—"a handful of dust which God enchants". For we must see the scientific Common Denominator in the light of the philosophic Greatest Common Measure.

Varying the metaphor, one of the foremost investigators,

Sir J. J. Thomson, writes: "As we conquer peak after peak we see in front of us regions full of interest and beauty, but we do not see our goal, we do not see the horizon; in the distance tower still higher peaks, which will yield to those who ascend them still wider prospects, and deepen the feeling, the truth of which is emphasised by every advance in science, that 'Great are the Works of the Lord.'"

These are the three voices of Nature. She joins hands with us; and says *Struggle, Endeavour.* She comes close to us, we hear her heart beating; she says *Wonder, Enjoy, Revere.* She whispers secrets to us, we cannot always catch her words; she says *Search, Enquire.* These three voices appeal to Hand and Heart and Head, to the trinity of our being. In listening to them we may be disciplined to hear even more august voices. Man's struggles for food and foothold have often helped him to much higher reaches of endeavour; to be thrilled with beauty may be a step to loving goodness; to try to find out scientifically what is true in Nature may be the beginning of waiting patiently upon the Lord. But our point is that to listen to the three voices of Nature is in itself worth while. It is a necessary and natural discipline of the developing human spirit.

We are familiar with the story of a rugged and very human Hebrew prophet, who after severe discipline climbed a mountain and heard the three voices of Nature. First, there was a great and strong wind,—a symbol of the practical voice, surely, which commands man to build his house upon a rock and to struggle against the storm, which teaches the sailor to trim his sails and the husbandman to prepare for the rain. Second, there was an earthquake,—a symbol of the emotional voice, surely, for is there anything so awful that stirs man and beast more deeply, that moves us down

to the primeval bed-rock of human nature laid down in the time of the cave-dwellers. Third, there was the fire,—a symbol of the scientific voice, surely, for the fire of science burns up rubbish, melts out the gold, reduces things to a common denominator, and gives light to Man. Now it seemed to the prophet that God was not in the wind, nor in the earthquake, nor in the fire, and it seems strictly correct to say that listening to the three voices of Nature is not in itself religious. But it is a good thing to listen, and it may form a preparation for religion. It was so in the prophet's case, for after the echoes of the wind and the earthquake and the fire had died away, he heard a still, small voice—God's voice—a sound of gentle stillness, the Margin says—which spoke very incisively to him. It was a great experience to the prophet to have heard the three voices of Nature, but it meant more for him practically to hear the still small voice. And it may be that in *obeying* it he understood afterwards that God *was* in the other voices too.

So when we pass from the cold evening-light of science, which the schoolmen called *cognitio vespertina,* to the morning-light of religion, which they called *cognitio matutina,* we may be able to agree with Ruskin's fine words (engraved on the memorial at Keswick): "The Spirit of God is around you in the air that you breathe, His glory in the light that you see, and in the fruitfulness of the earth and the joy of its creatures He has written for you day by day His revelation, and He has granted you day by day your daily bread."

§ 5. *Scientific Description of Animate Nature not Inconsistent with Religious Interpretation.*

We cannot reach any religious truth or conviction along scientific lines, but we have tried to show that a careful

scientific description of Animate Nature is not inconsistent with a spiritual—*i.e.,* religious or philosophical—interpretation.

Although some will not agree, we hold it to be historically true that just as there is a science that knows Nature, so there is a Religion that knows God; and throughout our studies we have not concealed our conviction that it is unprofitable to pit against one another these two distinct ways of working towards truth. For they are not antithetic but complementary. Perhaps it would be well if the devotees of Science were more aware of its limitations, perhaps it would be well if the religious who have the vision of God knew a little more about His works, but what must be sought after by both is a position from which haply there may be seen the unity of Huxley's science and Wordsworth's vision. The results of Science must, we think, be taken up as "harmonious elements in a system of truth wider than themselves; a system in whose wider light their ultimate significance for life and for the meaning of life would become manifest" (Blewett, 1907, p. 52).

We venture to hope that our study of Animate Nature may have shown it to be less dæmonic and more divine than many, from Aristotle onwards, have supposed; we should regret having spoken at all if our study has led any one to suppose that Animate Nature is not greater than our greatest thought of it. For the facts of the case from first to last are so wonderful that we venture to say that no general impression of Nature reached along scientific or any other lines can be even in the direction of being true that does not sound the note of joyous appreciation and of reverent wonder. As Walt Whitman said, "Prais'd be the

fathomless Universe, for life and joy, and for objects and knowledge curious."

Or take part of William Watson's poem:

"Nay, what is Nature's
Self, but an endless
Strife towards music,
Euphony, rhyme?

Trees in their blooming,
Tides in their flowing,
Stars in their circling,
Tremble with song.

God on His throne is
Eldest of poets;
Unto His measures
Moveth the whole."

But even that is not warm enough. We have missed the substance if the study of Animate Nature leaves us cold. Take rather this from Ralph Hodgson's *Song of Honour:*

"I heard the universal choir,
The Sons of Light, exalt their Sire
With universal song;
Earth's lowliest and loudest notes,
Her million times ten million throats,
Exalt him loud and long,
And lips and lungs and tongues of grace,
From every part and every place,
Within the shining of his face,
The universal throng."

Let us listen to Goethe, at once scientific investigator and poet:

"Nature! We are surrounded and embraced by her: powerless to separate ourselves from her . . .

We live in her midst and know her not. She is incessantly speaking to us, yet betrays not her secret . . .

She rejoices in illusion. Whoso destroys it in himself and others, him she punishes with the sternest tyranny. Whoso follows her in faith, him she takes as a child to her bosom.

She wraps man in darkness, and makes him for ever long for light. She creates him dependent upon the earth, dull and heavy; and yet is always shaking him until he attempts to soar above it . . .

I praise her and all her works.

She has brought me here and will also lead me away. I trust her. She may scold me, but she will not hate her work.

Every one sees her in his own fashion. She hides under a thousand names and phrases, and is always the same.

I praise her and all her works. She is silent and wise. I trust her."

But we cannot worship Nature. We cannot be grateful to a system. We cannot find abiding human satisfaction in Nature's voices alone. Invigorating, inspiring, and instructive they certainly are, but they are full of perplexities, and it is with a sad wistfulness that we hear their echoes dying away in the quietness of our minds like the calls of curlews on the moor as they pass further into the mist. Happy, then, are those who have what Sir Thomas Browne called "a glimpse of incomprehensibles, and thoughts of things that thoughts but tenderly touch". Shall we not seek to worship Him whom Nature increasingly reveals, from whom all comes and by whom all lives?

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